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(54) DISPOSABLE DIAPER

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(57) ABSTRACT

A disposable diaper includes a briefs-type cover component having an elastic stretchability in a vertical direction of the diaper, and an absorbent component including topsheet and backsheet both being not elastically stretchable and a liquid-absorbent core disposed therebetween. The absorbent component is suspended inside the cover component by suspender means made of non-stretchable sheets and having pleats adapted to be flattened out in a vertical direction of the diaper.

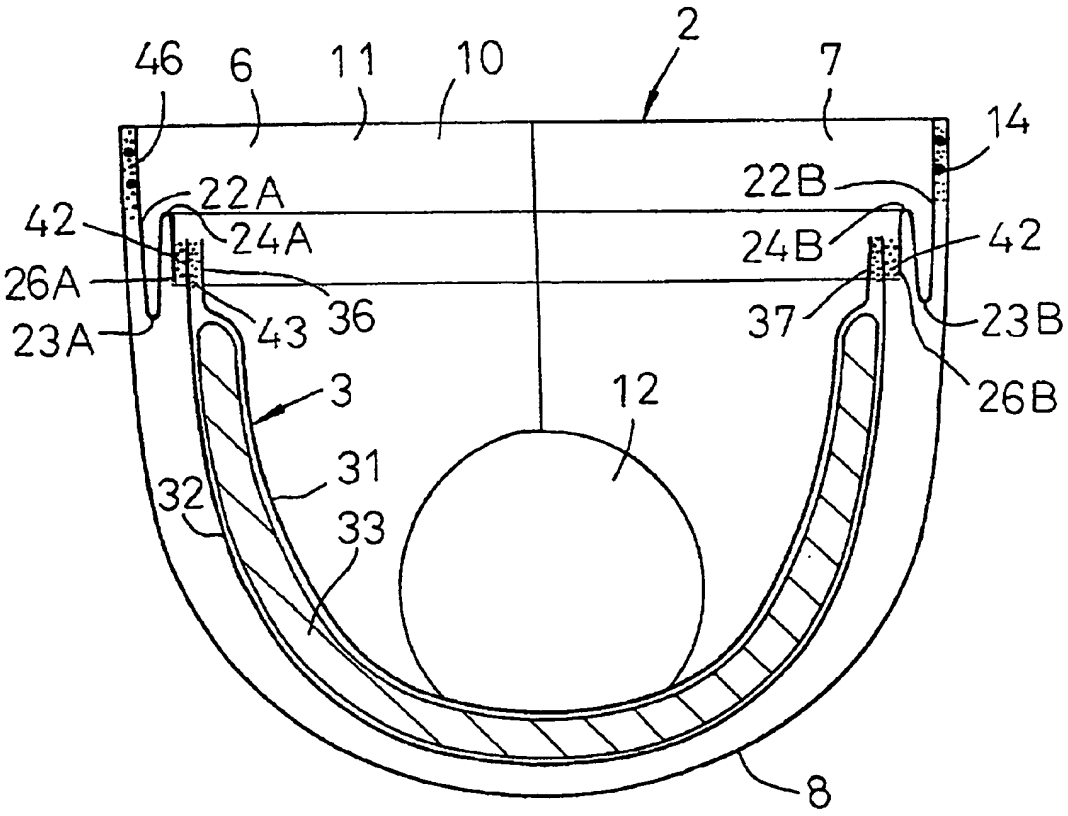


FIG. 1

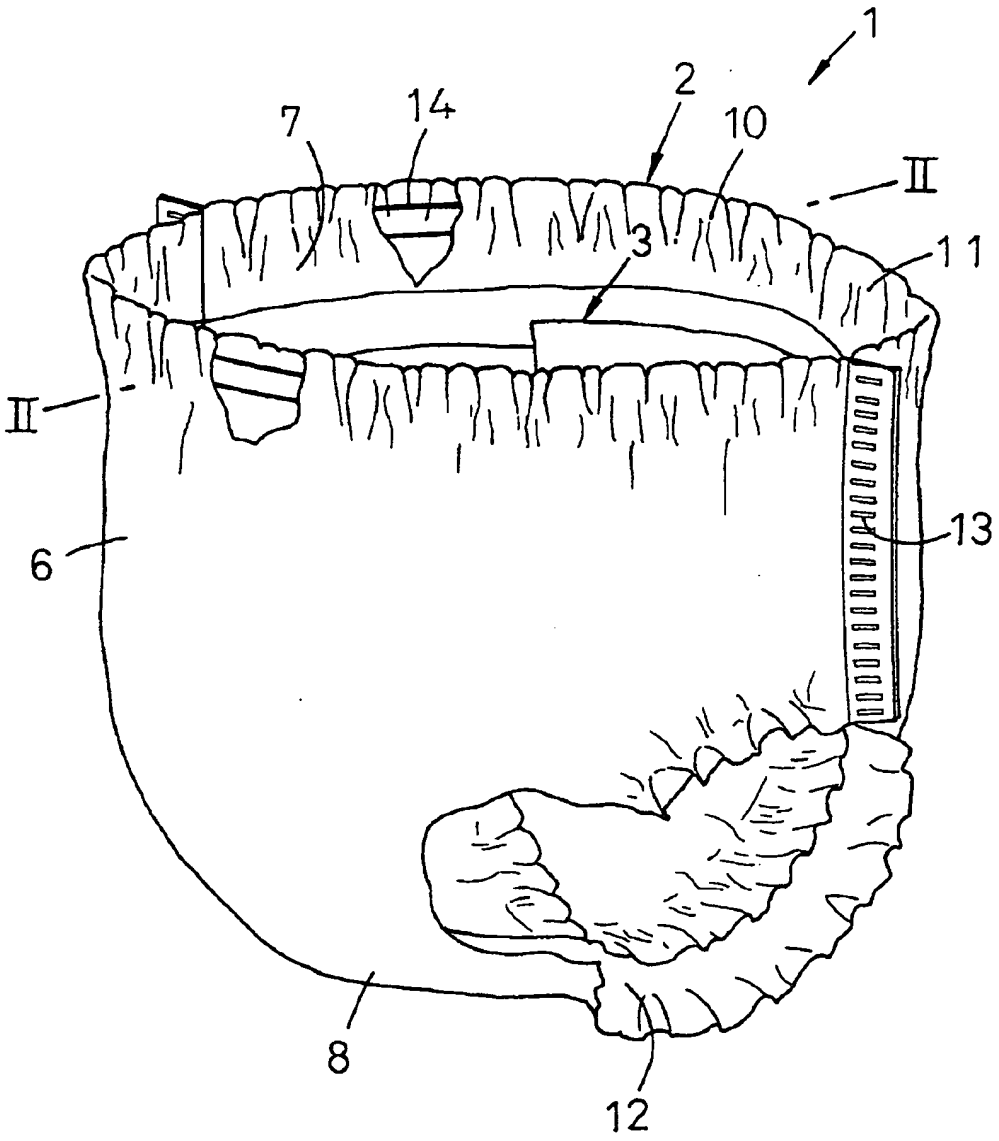
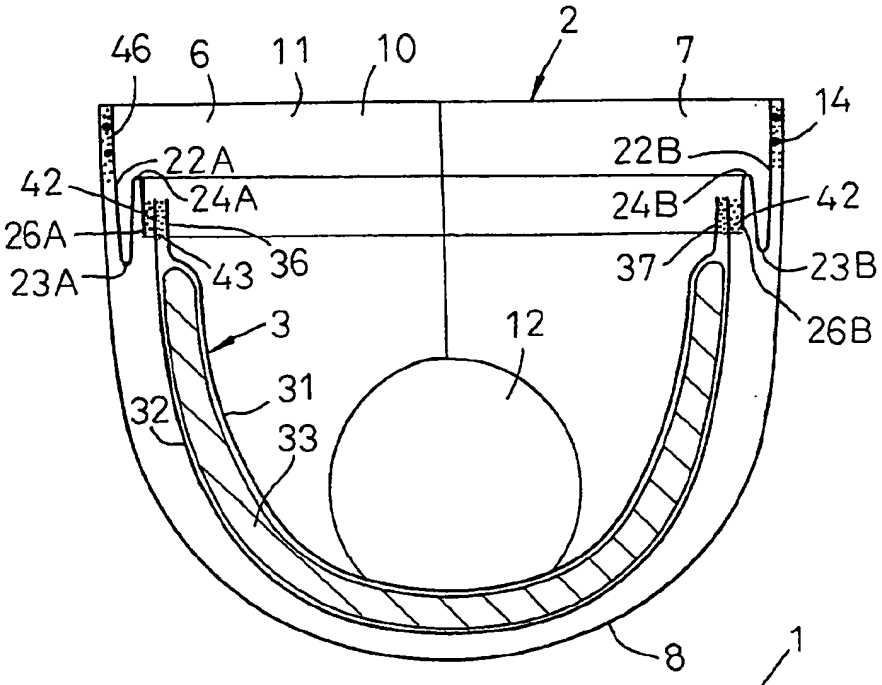


FIG.2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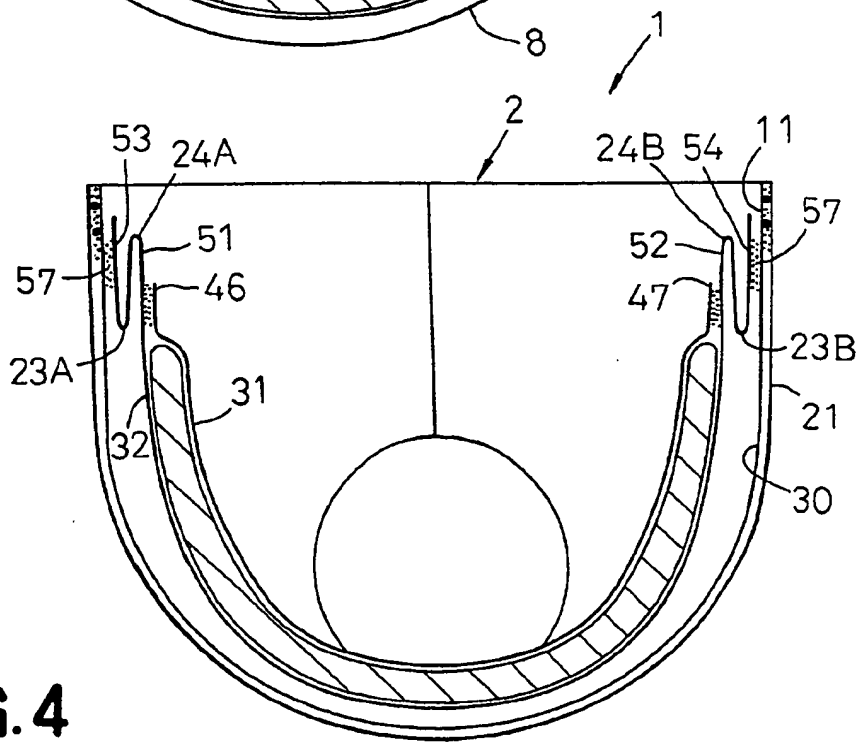
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FIG.4

FIG.3

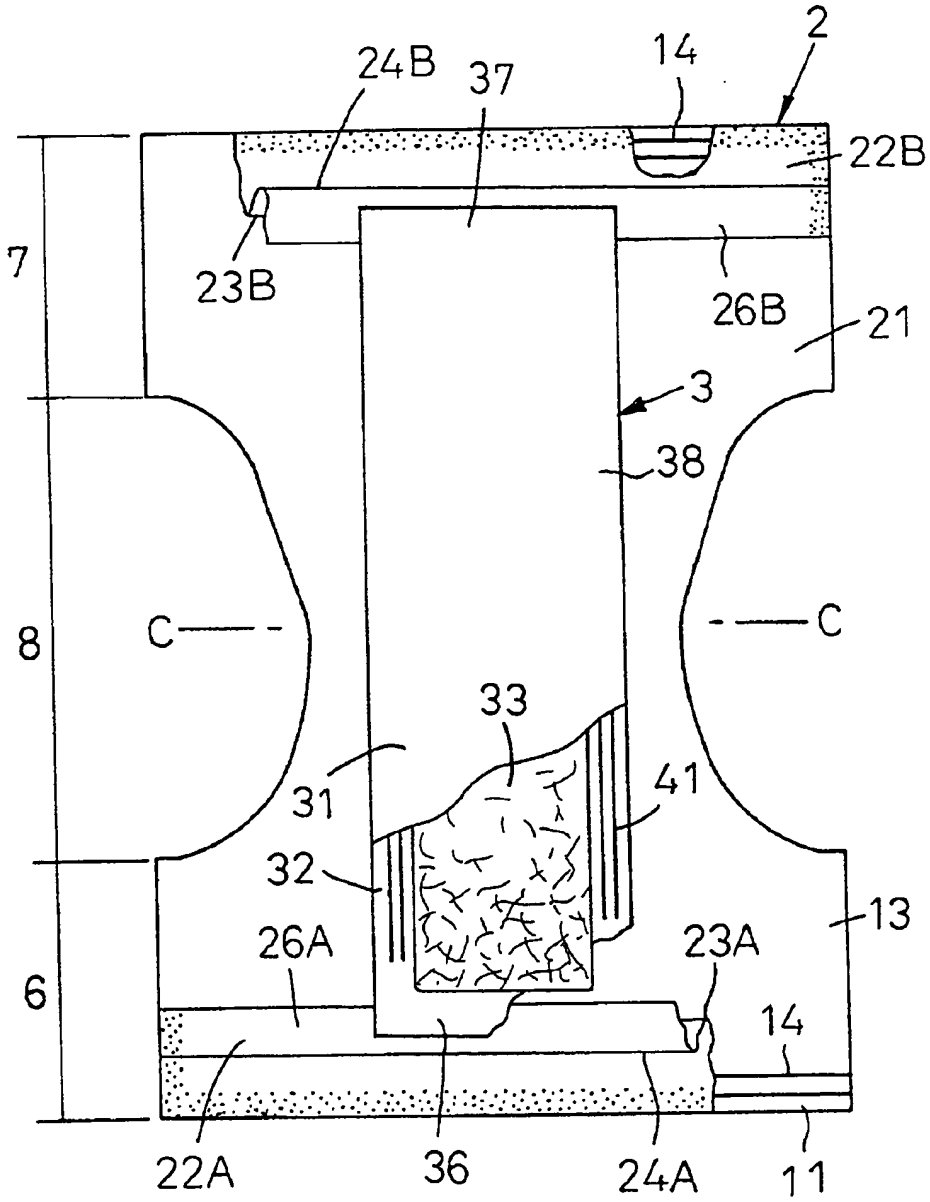
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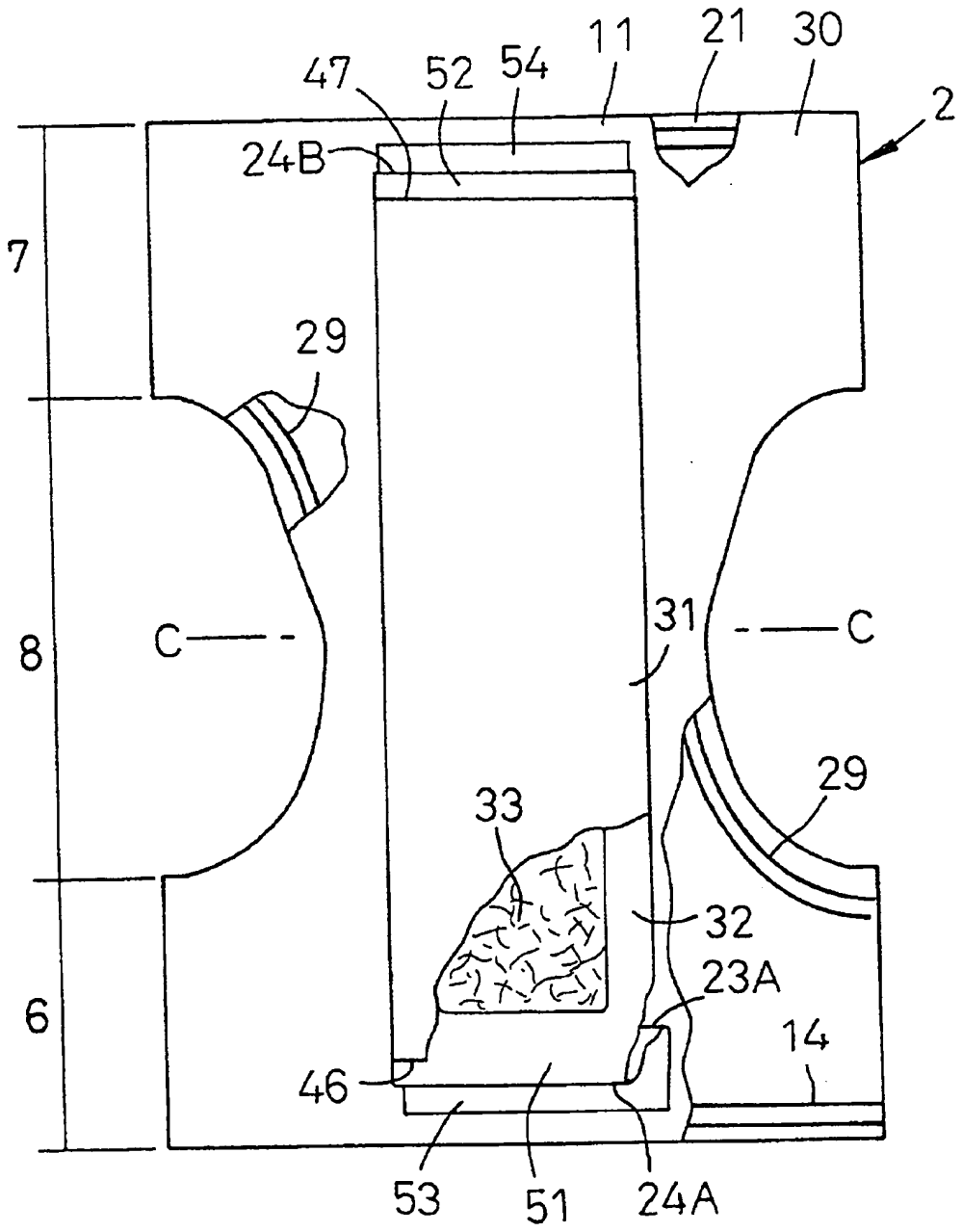
FIG. 5



DISPOSABLE DIAPER

BACKGROUND OF THE INVENTION

[0001] This invention relates to a disposable diaper for absorbing and containing body exudates.

[0002] Japanese Utility Model Application Disclosure Gazette (Kokai) No. Hei3-122824 discloses an absorbent garment comprising a stretchable topsheet, a stretchable backsheet and a water-absorbent panel disposed between these two sheets, wherein the topsheet and the panel are bonded to each other at a plurality of dots.

[0003] However, this known garment is disadvantageous in that the topsheet has its intrinsic stretchability remarkably lessened in its region bonded to the panel and can offer its intrinsic stretchability only in its region extending outwards beyond a peripheral edge of the panel. Consequently, a stretchability of the topsheet which can be utilized during practical use of the garment will be no more than the stretchability offered by an extremely limited portion of the topsheet in spite of intentionally using both the topsheet and the backsheet which are entirely stretchable. Generally, a stretchable sheet is relatively expensive and therefore a noticeable cost performance can not be expected so far as the stretchable sheet is used in the manner of the above-mentioned prior art.

SUMMARY OF THE INVENTION

[0004] In view of the problem as has been mentioned above, it is an object of the invention to provide a disposable diaper so improved that a sheet as an important member of the diaper and having a stretchability in a vertical direction of the diaper can be efficiently stretched.

[0005] According to the invention, there is provided a disposable diaper basically comprising a briefs-type cover component having a front a waist region, a rear waist region and a crotch region extending between these two waist regions so as to form a waist-opening and a pair of leg-openings, and an absorbent component formed separately of the cover component, the absorbent component comprising a liquid-pervious topsheet, a liquid-impervious backsheet and a liquid-absorbent core disposed therebetween, and the absorbent component longitudinally extending on an inner side of the cover component from the crotch region into the front and rear waist regions.

[0006] This disposable diaper is characterized by that: the cover component is elastically stretchable in a vertical direction of the diaper; absorbent component is not elastically stretchable in a vertical direction and connected to an inner surface of the cover component in the proximity of the waist-opening in the front and rear waist regions by suspender sheets which are not elastically stretchable in the vertical direction; and the suspender sheets are respectively formed with pleats which extend circumferentially of the waist regions and can be flatten out in the vertical direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] **FIG. 1** is a perspective view showing a disposable diaper according to the invention as partially broken away;

[0008] **FIG. 2** is a sectional view taken along a line II-II in **FIG. 1**;

[0009] **FIG. 3** is a plan view showing the diaper of **FIG. 1** as front and rear waist regions are separated from each other along their transversely opposite side edges and then flattened out with an inside of the diaper facing upwards, as partially broken away;

[0010] **FIG. 4** is a view similar to **FIG. 2** showing a specific embodiment of the invention; and

[0011] **FIG. 5** is a view similar to **FIG. 3** showing the specific embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Details of a disposable diaper according to the invention will be more fully understood from the description given hereunder with reference to the accompanying drawings.

[0013] Disposable diaper 1 shown by **FIG. 1** in a perspective view as partially broken away generally consists of a briefs-type cover component **2** and an absorbent component **3** attached to an inner side of the cover component **2**.

[0014] The cover component **2** comprises a front waist region **6**, a rear waist region **7** and a crotch region **8** extending between these two waist regions **6**, **7** so as to define a waist-opening **10** and a pair of leg-openings **12**. The front and rear waist regions **6**, **7** are placed flat together along their transversely opposite side edges and joined to each other at a plurality of joining zones **13** intermittently arranged in a vertical direction along each side edge. The waist-opening **10** is provided with an elastic member **14** circumferentially extending under appropriate tension.

[0015] **FIG. 2** is a sectional view taken along a line II-II in **FIG. 1** and **FIG. 3** is a plan view showing the diaper **1** of **FIG. 1** as the front and rear waist regions **6**, **7** are separated from each other along the joining zones **13** and flattened out with an inside of the diaper **1** facing upwards, as partially broken away. The cover component **2** is hourglass-shaped and basically made of an elastic sheet **21** which is stretchable in a vertical direction of the diaper **1**. The cover component **2** further includes a pair of suspender sheets **22A**, **22B** which are not stretchable in a vertical direction of the diaper **1** and respectively attached to inner surfaces of the front and rear waist regions **6**, **7** along peripheral edges of the waist-opening. These suspender sheets **22A**, **22B** are used to connect the absorbent component **3** to the cover component **2** and extend in parallel to a center line C-C dividing a longitudinal dimension of the diaper **1** in two. The suspender sheets **22A**, **22B** are folded along first folding lines **23A**, **23B** lying relatively near the center line C-C and along second folding lines **24A**, **24B** lying relatively remote from the center line C-C to form pleats presenting Z- and inverted Z-shaped cross-sections, respectively. The suspender sheets **22A**,**22B** are joined to the inner surface of the cover component **2** along the peripheral edges **11** of the waist-opening **10** and the transversely opposite side edges **13** by means of hot melt adhesive **46** indicated by a plurality of dots so as to form relatively deformable pleats **26A**, **26B** on the sides of these suspender sheets **22A**, **22B** opposed to the center line C-C, respectively. The elastic member **14** circumferentially extending is secured, under appropriate tension, to the inner surface of the cover component **2** along the peripheral edges **11** of the waist-opening **10** and covered with the suspender

sheets 22A, 22B. It is also possible to dimension these suspender sheets 22A, 22B so that they are narrower than a width of the diaper 1 and larger than a width of the absorbent component 3. In this case, the suspender sheets 22A, 22B may be joined to the cover component 2 along the peripheral edges 11 of the waist-opening 10 alone.

[0016] The absorbent component 3 has a rectangular shape longitudinally larger as seen in FIG. 3 and comprises a liquid-pervious topsheet 31, a liquid-impervious backsheet 32 and a liquid-absorbent core 33 disposed between these two sheets 31, 32. The rectangular shape is defined by longitudinally opposite ends 36, 37 extending transversely of the cover component 2 and transversely opposite side edges 38, 38 extending longitudinally of the cover component 2. The topsheet 31 and the backsheet 32 which are not elastically stretchable extend outwards beyond peripheral edges of the core 33 and are bonded to each other along such extensions by means of hot melt adhesive 43. The absorbent component 3 is provided along its transversely opposite side edges with elastically stretchable members 41, 41 longitudinally extending between the topsheet 31 and the backsheet 32 and secured to at least one of these sheets 31, 32. The longitudinally opposite ends 36, 37 of the absorbent component 3 have their outer surfaces bonded to the pleats 26A, 26B of the suspender sheets 22A, 22B on their inner surfaces, respectively, by means of hot melt adhesive 42. The core 33 is formed by fluff pulp fibers or a mixture of fluff pulp fibers and superabsorptive polymer particles and neither stretchable nor contractible.

[0017] After the diaper 1 of such arrangement has been put on a wearer's body, the sheet 21 is elastically stretched upwards and thereby the pleats of the suspender sheets 22A, 22B are flattened out as the cover component 2 is pulled upwards. Dimensions between the first and second folding lines 23A and 24A; 23B and 24B of the respective suspender sheets 22A, 22B in a vertical direction of the diaper 1 may be appropriately selected to ensure that stretching of the elastic sheet 21 should not be restricted.

[0018] FIGS. 4 and 5 are views similar to FIGS. 2 and 3, respectively, showing a specific embodiment of the invention. Of this diaper 1, the cover component 2 comprises a first elastic sheet 21 and a second elastic sheet 30 placed upon the inner surface of the first elastic sheet 21. These first and second elastic sheets 21, 30 identical in shape and size are elastically stretchable in a vertical direction of the diaper 1. Along the peripheral edges 11 of the waist-opening 10 and the transversely opposite side edges of the crotch region 8 in the cover component 2, elastically stretchable members 14, 29 extend circumferentially of a wearer's waist and legs, respectively, between the first and second sheets 21, 30, to at least one of which these elastic members 14, 29 are secured. The first and second elastic sheets 21, 30 are bonded to each other by means of hot melt adhesive (not shown) intermittently distributed to avoid that each of these two elastic sheets 21, 30 might restrict stretchability as well as contractibility of the other elastic sheet 21 or 30.

[0019] The topsheet 31 and the backsheet 32 of the absorbent component 3 are not elastically stretchable in a vertical direction of the diaper 1. While the topsheet 31 and the backsheet 32 are identical with each other so far as their widths are concerned, the backsheet 32 is relatively long and extends outwards beyond the longitudinally opposite ends 46, 47 of the topsheet 31 to define suspender flaps 51, 52. These suspender flaps 51, 52 are folded along the first folding lines 23A, 23B lying relatively near the center line C-C of the diaper 1 and along the second folding lines 24A, 24B lying relatively remote from the center line C-C so as to form pleats. Distal ends 53, 54 of the suspender flaps 51, 52 are joined to the second elastic sheet 30 in the proximity of the peripheral edges 11 of the waist-opening 10 by means of hot melt adhesive 57 (See FIG. 4).

[0020] In the case of such diaper 1, the pleats of the suspender flaps 51, 52 are flattened out as the cover component 2 is pulled upwards, so that the desired elastic stretching of the cover component 2 is not obstructed. With this diaper 1, the suspender flaps 51, 52 of the absorbent component 3 function in the same manner as the suspender sheets 22A, 22B shown in FIGS. 2 and 3. Substantially the same effect as the effect offered by the diaper 1 of FIGS. 1-3 can be achieved when a pair of non-stretchable sheets are used as the suspender and these sheets are bonded to the cover component 2 as well as to the absorbent component 3.

[0021] To exploit this invention, the suspender sheets 22A, 22B may be made of a woven fabric, a nonwoven fabric, a plastic sheet material or a laminate comprising some of them, all of which are not elastically stretchable in a vertical direction of the diaper 1. The backsheet 32 including the suspender flaps 51, 52 functioning in the same manner as the suspender sheets 22A, 22B may be made of a woven fabric, a nonwoven fabric or a plastic sheet material, all of which are also not elastic stretchable and liquid-impervious. The liquid-pervious topsheet 31 may be made of a nonwoven fabric or an apertured plastic sheet. The first and second elastic sheets 21, 30 forming the cover component 2 may be made of a woven fabric, a nonwoven fabric, a plastic sheet material or a laminate comprising some of them, all of which are not elastically stretchable. Bonding of various members may be achieved by utilizing suitable adhesive agents such as hot melt adhesive or heat-sealing technique.

[0022] The disposable diaper according to the invention basically comprises the cover component having elastic stretchability in a vertical direction of the diaper and the absorbent component which is formed separately of the cover component and not elastically stretchable wherein these two basic components are connected to each other by the suspender sheets being not stretchable and folded so as to form the pleats adapted to be flattened out in a vertical direction of the diaper. This unique arrangement ensures that the desired stretchability as well as contractibility of the cover component in the vertical direction should not be obstructed.

What is claimed is:

1. A disposable diaper comprising a briefs-type cover component having a front waist region, a rear waist region and a crotch region extending therebetween so as to form a waist-opening and a pair of leg-openings and an absorbent component formed separately of said cover component, said absorbent component comprising a liquid-pervious topsheet, a liquid-impervious backsheet and a liquid-absorbent core disposed therebetween, and said absorbent component longitudinally extending on an inner side of said cover component from said crotch region into said front and rear waist regions, wherein:

said cover component is elastically stretchable in a vertical direction of said diaper;

said absorbent component is not elastically stretchable in said vertical direction and connected to the inner surface of said cover component in the proximity of the waist-opening in said front and rear waist regions by suspender sheets which are not elastically stretchable in said vertical direction; and

said suspender sheets are respectively formed with pleats which extend circumferentially of said waist regions and can be flattened out in said vertical direction.

2. A disposable diaper according to claim 1, wherein said suspender sheets are formed separately of said cover component.

3. A disposable diaper according to claim 1, wherein said suspender sheets are formed with a part of said backsheet.

4. A disposable diaper according to claim 1, wherein said cover component comprises first and second elastic sheets which are placed one upon another and intermittently bonded.

5. A disposable diaper according to claim 1, wherein said absorbent component is provided along transversely opposite side edges thereof with elastically stretchable members.

* * * * *

US006679869B1

(12) **United States Patent**
Schlinz et al.

(10) **Patent No.: US 6,679,869 B1**
(45) **Date of Patent: Jan. 20, 2004**

(54) **ABSORBENT ARTICLE HAVING AN ELASTIC OUTER COVER**

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(73) Assignee: **Kimberly-Clark Worldwide, Inc.**, Neenah, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 18 days.

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(22) Filed: **Aug. 16, 2000**

(51) **Int. Cl.**[7] **A61F 13/15**

(52) **U.S. Cl.** **604/385.22**; 604/385.02; 604/385.27

(58) **Field of Search** 604/358, 362, 604/367, 375, 385.01, 385.23, 387, 385.22, 385.24, 385.27

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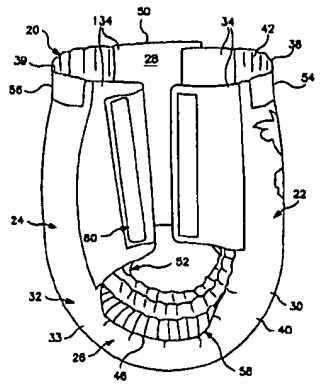
Primary Examiner—Weilun Lo
Assistant Examiner—Jacqueline F Stephens
(74) *Attorney, Agent, or Firm*—Pauley Petersen & Erickson

(57) **ABSTRACT**

A laminate including an elastic nonwoven layer and a barrier film layer can stretch freely and provide a high level of breathability. The elastic layer and the film layer can be minimally bonded to one another, such as around a periphery of one or both layers. The laminate is particularly suitable for making absorbent articles.

32 Claims, 5 Drawing Sheets



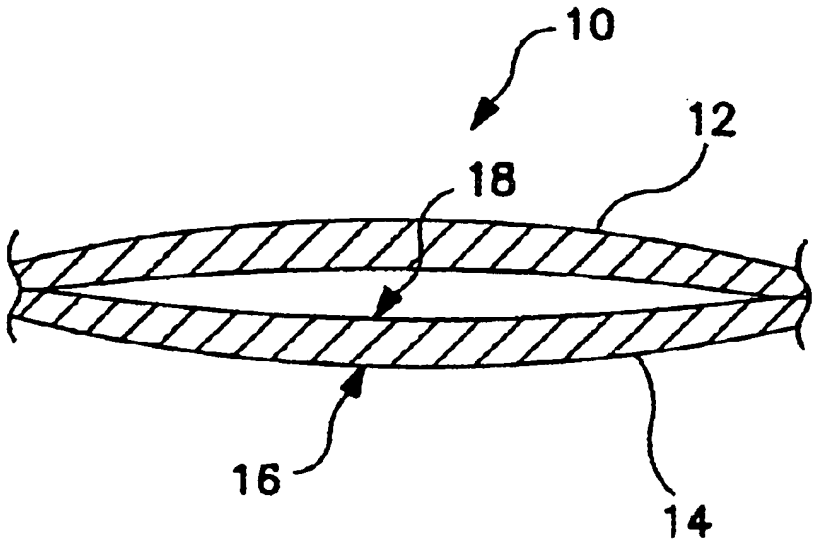


FIG. 1

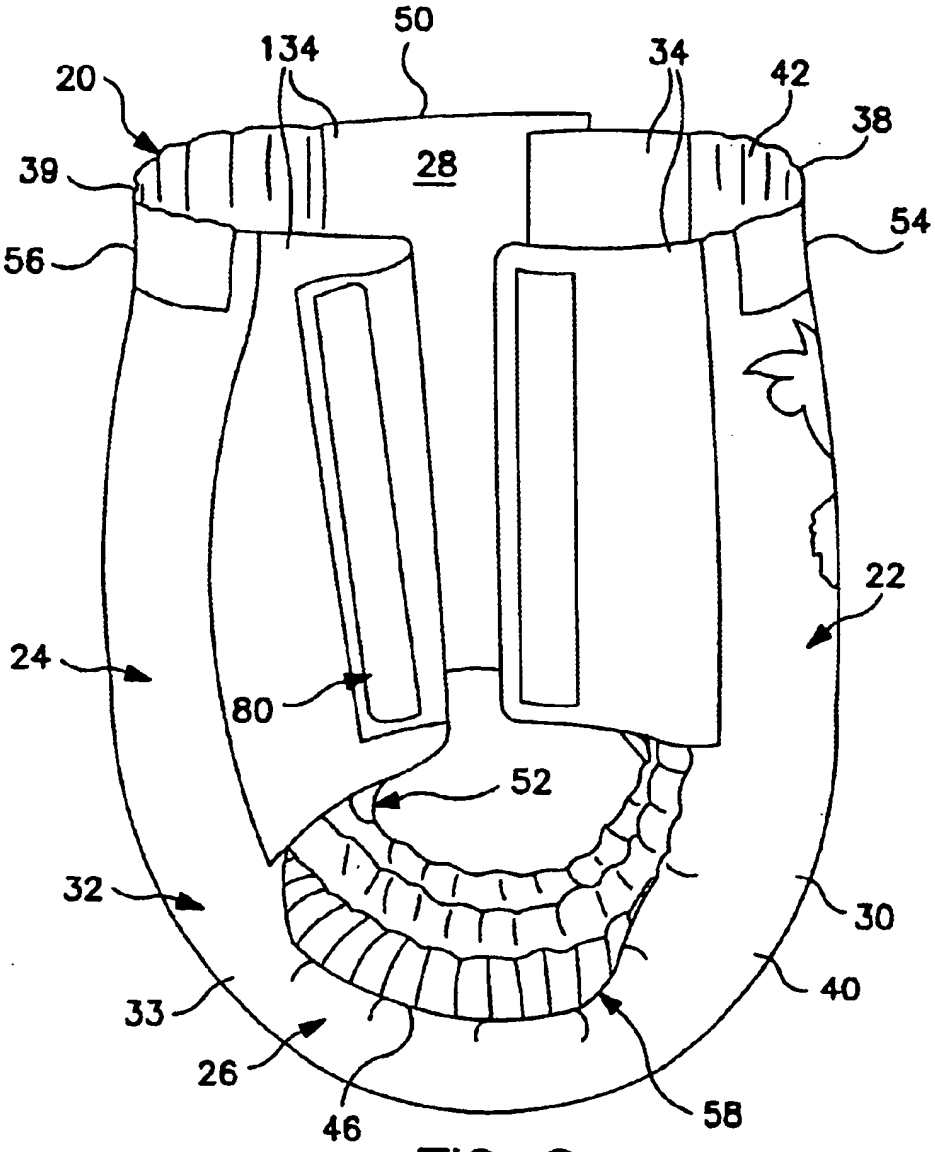


FIG. 2

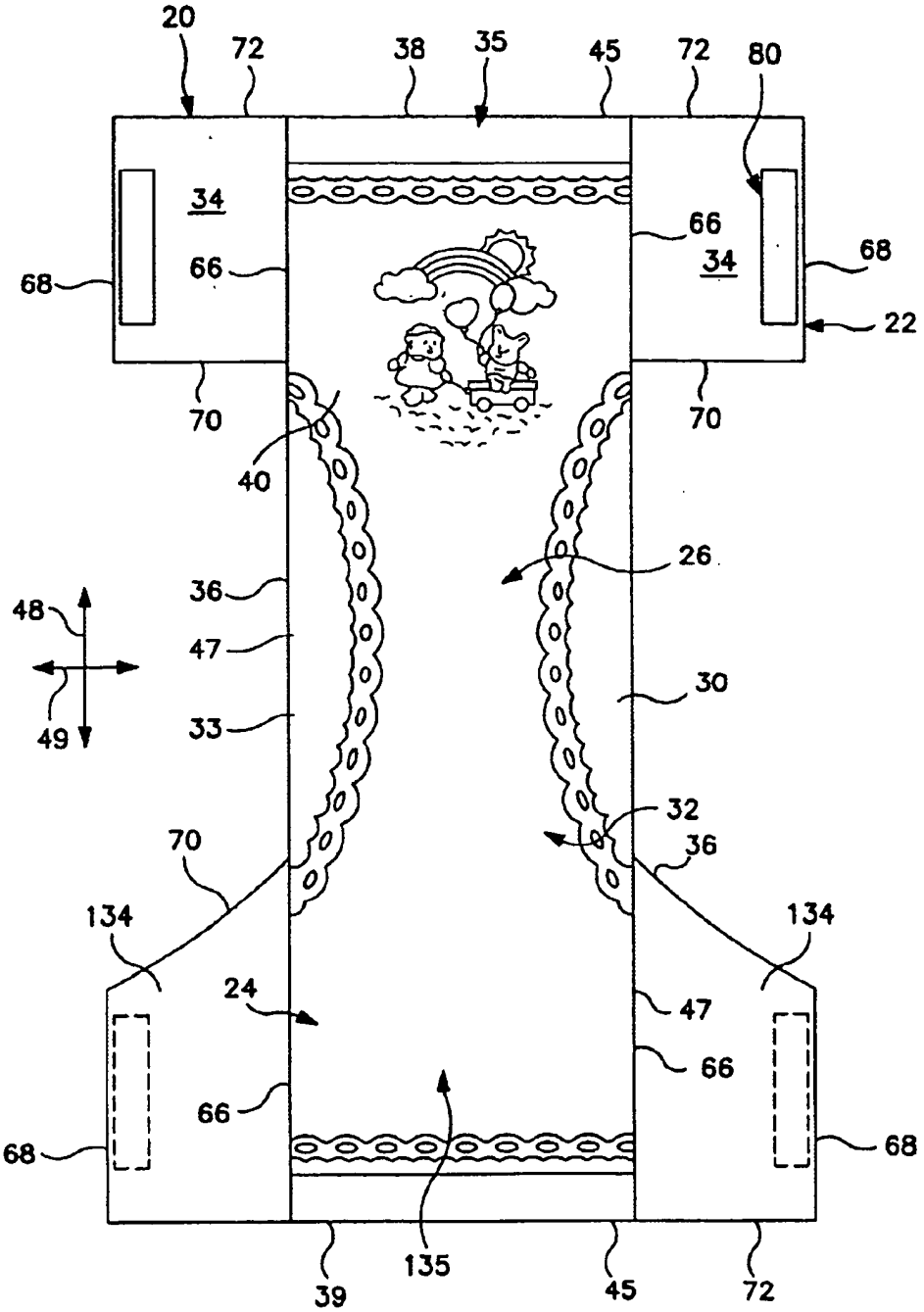

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FIG. 3

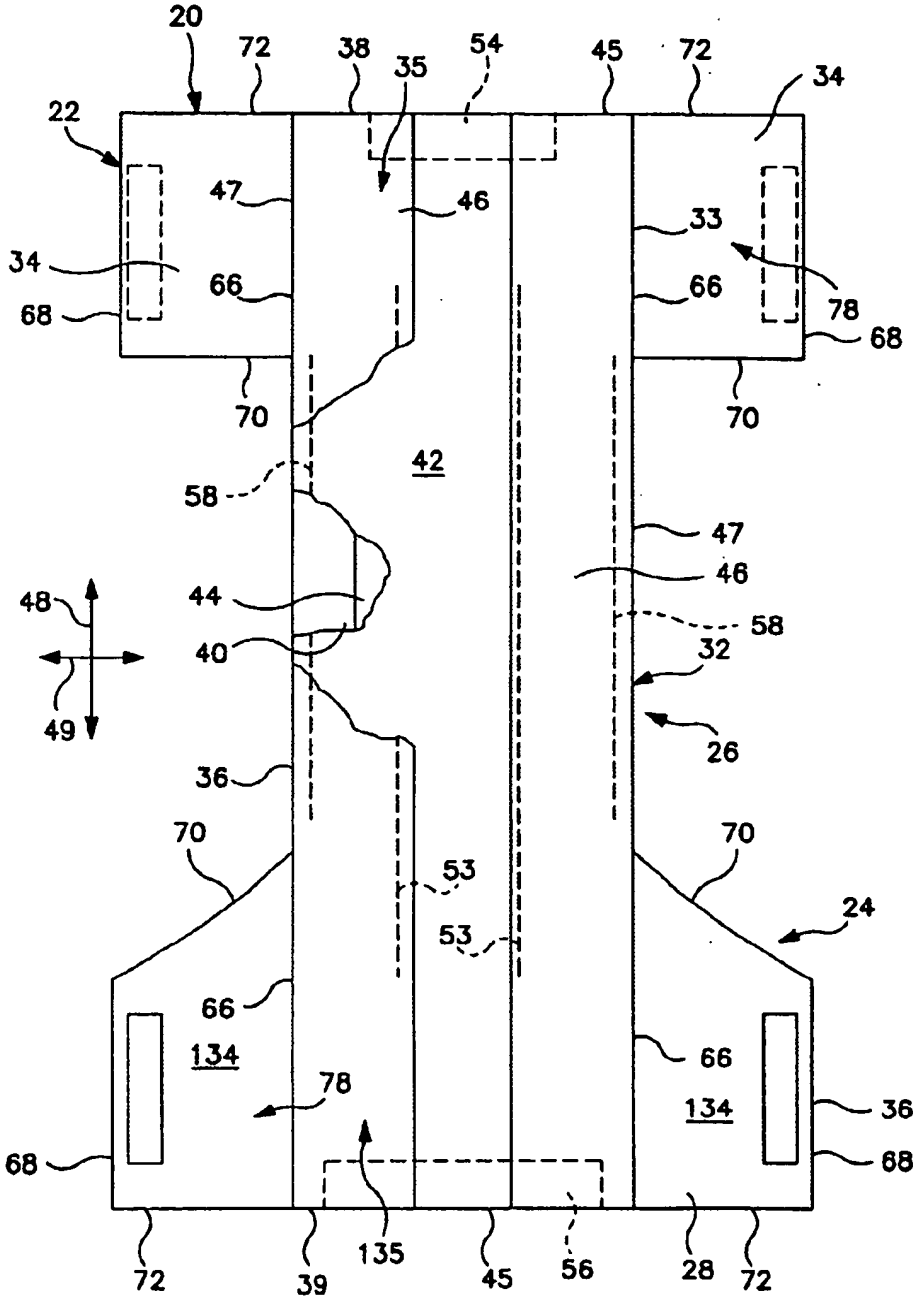
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FIG. 4

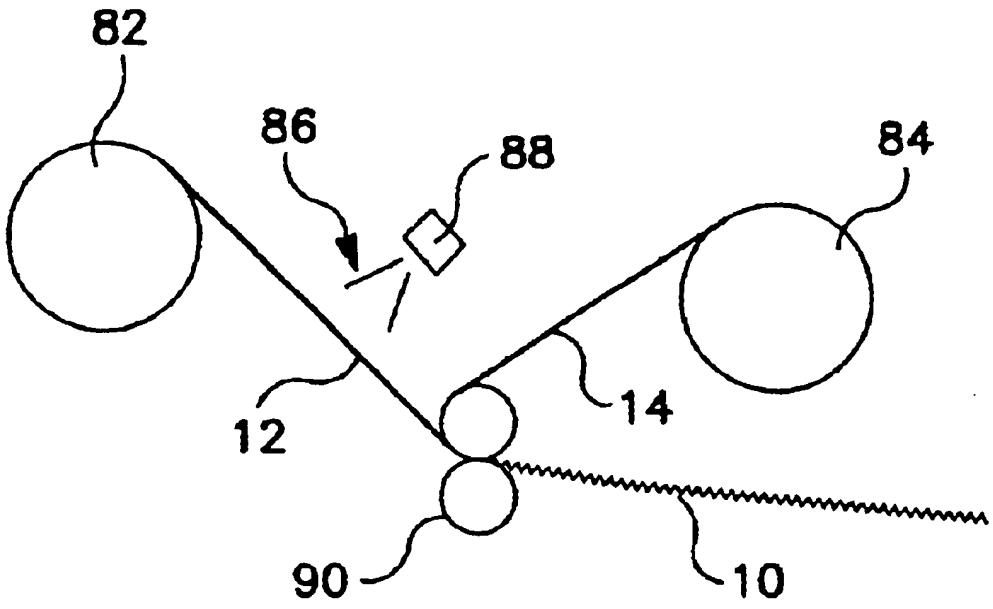

FIG. 5

ABSORBENT ARTICLE HAVING AN ELASTIC OUTER COVER

FIELD OF THE INVENTION

This invention is directed to a laminate having independently movable elastic and film layers. The laminate is particularly suitable for use as an outer cover for absorbent articles.

BACKGROUND OF THE INVENTION

Absorbent articles typically include a film layer to prevent fluids, such as bodily wastes, from leaking through the article. Such films can be breathable, thereby allowing vapors to escape while maintaining the liquids within the article. Absorbent articles typically also include elastic elements in order to create a form-fit in such areas as leg openings and waist openings.

Two or more types of material can be layered together to create a laminate that includes the properties of each material therein. For example, the process of "zero strain" stretch bonding, as disclosed in U.S. Pat. Nos. 5,143,679 and 5,167,897 both issued to Weber, et al., includes bonding at least two layers to one another while in an untensioned (hence zero strain) condition. Of the at least two layers, one of the layers is stretchable and elastomeric and another layer is stretchable but not necessarily elastomeric. The laminate is stretched incrementally through the use of one or more pairs of meshing corrugated rolls which reduce the strain rate experienced by the web. The layer that is stretchable but not necessarily elastomeric, upon being stretched in the laminate, becomes permanently elongated, at least to a degree, so that the laminate will not return to its original undistorted condition upon release of the stretching force. The resulting laminate has z-direction bulking and elastic extensibility in the direction of initial stretching at least up to the point of initial stretching.

Absorbent articles made with a zero strain stretch laminate composite elastic material, such as the absorbent articles disclosed in U.S. Pat. No. 5,151,092 issued to Buell, et al., and U.S. Pat. No. 5,196,000 issued to Clear, et al., have discrete elasticized portions, such as side panels and waist bands. An inherent property in the zero strain stretch laminate is the z-direction bulking which is therefore present in the absorbent articles made with such material. Furthermore, the elastic extensibility of the zero strain stretch laminate is limited to the point of initial stretching. Human beings, particularly babies, are typically active and vary greatly in terms of body contours. Absorbent garments worn by such active people must be able to move with the wearer and remain close to the wearer's skin to avoid leakage from the garment.

Necked spunbond and solid stretch film laminates have been proposed as outer covers that provide superior fit. These designs must stretch, breathe, engage fastener hooks and be aesthetically pleasing all with the same material.

There is a need for a lower priced laminate, suitable for making absorbent articles, that can stretch freely and also provide a high level of breathability.

There is a further need for a laminate, suitable for making absorbent articles, that can provide an aesthetically pleasing appearance at a relatively low cost without fear of leakage.

SUMMARY OF THE INVENTION

The present invention is directed to a laminate that can stretch freely and provide a high level of breathability. This

laminate is particularly suitable for making absorbent articles. Furthermore, this laminate is relatively inexpensive to produce and provides an aesthetically pleasing appearance when used to make absorbent articles.

The laminate includes an elastic nonwoven layer, and a barrier film at least partially bonded to the elastic nonwoven layer. The barrier film and the elastic nonwoven layer can suitably be bonded just about the periphery of one or both layers.

The barrier film can have a wide range of breathability, including a WVTR of over 5000 grams/m^2-24 hours. The elastic nonwoven layer can be any fiberous, or cloth-like, breathable elastic layer. For example, the elastic nonwoven layer can include a neck-bonded laminate, a stretch-bonded laminate, a spunbond-meltblown-spunbond laminate, a spunbonded laminate, or a meltblown laminate.

An absorbent article can be made from the laminate of the invention. For example, the laminate can be used as an outer cover, or backsheet, of a diaper or training pant. The barrier layer and the elastic nonwoven layer can be bonded together just around the leg openings and the waist opening, thereby providing great flexibility so that the elastic layer can move independently of the film layer. In addition, an elastic waistband can be attached to the garment around the waist opening and can be partially elongated when attached, so that the waist opening is maintained closely around the wearer's waist to prevent leakage from the garment. The laminate of the invention can also be used to make swim wear, adult incontinence garments, feminine hygiene products, or medical products.

With the foregoing in mind, it is a feature and advantage of the invention to provide a laminate, suitable for making absorbent articles, that can stretch freely and also provide a high level of breathability.

It is also a feature and advantage of the invention to provide an absorbent article having great flexibility and high breathability.

It is also a feature and advantage of the invention to provide a method of preparing a laminate with independently movable layers.

The foregoing and other features and advantages will become further apparent from the following detailed description of the presently preferred embodiments, read in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of one embodiment of the laminate of the invention;

FIG. 2 is a side perspective view of an absorbent garment having an elastic nonwoven outer cover;

FIG. 3 is a plan view of an absorbent garment in a partially disassembled, stretched flat state, and showing the surface of the article that faces away from the wearer when the article is worn;

FIG. 4 is a plan view of the absorbent garment of FIG. 3 in a partially disassembled, stretched flat state, and showing the surface of the article that faces the wearer when the article is worn, and with portions cut away to show the underlying features; and

FIG. 5 is a schematic diagram of an integrated process for making a laminate of the invention.

DEFINITIONS

Within the context of this specification, each term or phrase below will include the following meaning or meanings.

"Bonded" refers to the joining, adhering, connecting, attaching, or the like, of two elements. Two elements will be considered to be bonded together when they are bonded directly to one another or indirectly to one another, such as when each is directly bonded to intermediate elements.

"Connected" refers to the joining, adhering, bonding, attaching, or the like, of two elements. Two elements will be considered to be connected together when they are connected directly to one another or indirectly to one another, such as when each is directly connected to intermediate elements.

"Disposable" refers to articles which are designed to be discarded after a limited use rather than being laundered or otherwise restored for reuse.

"Disposed," "disposed on," and variations thereof are intended to mean that one element can be integral with another element, or that one element can be a separate structure bonded to or placed with or placed near another element.

"Elastic," "elasticized" and "elasticity" mean that property of a material or composite by virtue of which it tends to recover its original size and shape after removal of a force causing a deformation.

"Elastomeric" refers to a material or composite which can be elongated by at least 50 percent of its relaxed length and which will recover, upon release of the applied force, at least 50 percent of its elongation. It is generally preferred that the elastomeric material or composite be capable of being elongated by at least 100 percent, more preferably by at least 300 percent, of its relaxed length and recover, upon release of an applied force, at least 50 percent of its elongation.

"Fabrics" is used to refer to all of the woven, knitted and nonwoven fibrous webs.

"Film" refers to a thermoplastic film made using a film extrusion and/or foaming process, such as a cast film or blown film extrusion process. The term includes apertured films, slit films, and other porous films which constitute liquid transfer films, as well as films which do not transfer liquid.

"Flexible" refers to materials which are compliant and which will readily conform to the general shape and contours of the wearer's body.

"Hydrophilic" describes fibers or the surfaces of fibers which are wetted by the aqueous liquids in contact with the fibers. The degree of wetting of the materials can, in turn, be described in terms of the contact angles and the surface tensions of the liquids and materials involved. Equipment and techniques suitable for measuring the wettability of particular fiber materials or blends of fiber materials can be provided by a Cahn SFA-222 Surface Force Analyzer System, or a substantially equivalent system. When measured with this system, fibers having contact angles less than 90° are designated "wettable" or hydrophilic, while fibers having contact angles greater than 90° are designated "nonwettable" or hydrophobic.

"Layer" when used in the singular can have the dual meaning of a single element or a plurality of elements.

"Liquid impermeable," when used in describing a layer or multi-layer laminate, means that a liquid, such as urine, will not pass through the layer or laminate, under ordinary use conditions, in a direction generally perpendicular to the plane of the layer or laminate at the point of liquid contact. Liquid, or urine, may spread or be transported parallel to the plane of the liquid impermeable layer or laminate, but this is not considered to be within the meaning of "liquid impermeable" when used herein.

"Liquid permeable material" or "liquid water-permeable material" refers to a material present in one or more layers, such as a film, nonwoven fabric, or open-celled foam, which is porous, and which is water permeable due to the flow of water and other aqueous liquids through the pores. The pores in the film or foam, or spaces between fibers or filaments in a nonwoven web, are large enough and frequent enough to permit leakage and flow of liquid water through the material.

"Longitudinal" and "transverse" have their customary meaning, as indicated by the longitudinal and transverse axes depicted in FIGS. 3 and 4. The longitudinal axis lies in the plane of the article and is generally parallel to a vertical plane that bisects a standing wearer into left and right body halves when the article is worn. The transverse axis lies in the plane of the article generally perpendicular to the longitudinal axis. The article as illustrated is longer in the longitudinal direction than in the transverse direction.

"Meltblown fiber" means fibers formed by extruding a molten thermoplastic material through a plurality of fine, usually circular, die capillaries as molten threads or filaments into converging high velocity heated gas (e.g., air) streams which attenuate the filaments of molten thermoplastic material to reduce their diameter, which may be to microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting surface to form a web of randomly dispersed meltblown fibers. Such a process is disclosed for example, in U.S. Pat. No. 3,849,241 to Butin et al. Meltblown fibers are microfibers which may be continuous or discontinuous, are generally smaller than about 0.6 denier, and are generally self bonding when deposited onto a collecting surface. Meltblown fibers used in the present invention are preferably substantially continuous in length.

"Member" when used in the singular can have the dual meaning of a single element or a plurality of elements.

"Neck-bonded laminate" refers to a laminate wherein at least one layer of fabric, nonwoven web or sub-laminate is drawn such that it is extended under conditions reducing its width or its transverse dimension by stretching lengthwise or increasing the length of the fabric. The controlled drawing may take place under cool temperatures, room temperature or greater temperatures and is limited to an increase in overall dimension in the direction being drawn up to the elongation required to break the fabric, nonwoven web or laminate, which in most cases is about 1.2 to 1.6 times. When relaxed, the fabric, nonwoven web or sub-laminate does not return totally to its original dimensions. The necking process typically involves unwinding a sheet from a supply roll and passing it through a brake nip roll assembly driven at a given linear speed. A take-up roll or nip, operating at a linear speed higher than the brake nip roll, draws the fabric and generates the tension needed to elongate and neck the fabric. U.S. Pat. No. 4,965,122 issued to Morman, and commonly assigned to the assignee of the present invention, discloses a reversibly necked nonwoven material which may be formed by necking the material, then heating the necked material, followed by cooling and is incorporated herein by reference in its entirety. The heating of the necked material causes additional crystallization of the polymer giving it a partial heat set. If the necked material is a spunbond web, some of the fibers in the web may become crimped during the necking process, as explained in U.S. Pat. No. 4,965,122.

"Nonwoven" and "nonwoven web" refer to materials and webs of material which are formed without the aid of a textile weaving or knitting process.

"Operatively joined," in reference to the attachment of an elastic member to another element, means that the elastic member when attached to or connected to the element, or treated with heat or chemicals, by stretching, or the like, gives the element elastic properties; and with reference to the attachment of a nonelastic member to another element, means that the member and element can be attached in any suitable manner that permits or allows them to perform the intended or described function of the joinder. The joining, attaching, connecting or the like can be either directly, such as joining either member directly to an element, or can be indirectly by means of another member disposed between the first member and the first element.

"Permanently bonded" refers to the joining, adhering, connecting, attaching, or the like, of two elements of an absorbent garment such that the elements tend to be and remain bonded during normal use conditions of the absorbent garment.

"Polymers" include, but are not limited to, homopolymers, copolymers, such as for example, block, graft, random and alternating copolymers, terpolymers, etc. and blends and modifications thereof. Furthermore, unless otherwise specifically limited, the term "polymer" shall include all possible geometrical configurations of the material. These configurations include, but are not limited to isotactic, syndiotactic and atactic symmetries.

"Releasably attached," "releasably engaged" and variations thereof refer to two elements being connected or connectable such that the elements tend to remain connected absent a separation force applied to one or both of the elements, and the elements being capable of separation without substantial permanent deformation or rupture. The required separation force is typically beyond that encountered while wearing the absorbent garment.

"Spunbonded fiber" refers to small diameter fibers which are formed by extruding molten thermoplastic material as filaments from a plurality of fine capillaries of a spinnerette having a circular or other configuration, with the diameter of the extruded filaments then being rapidly reduced as by, for example, in U.S. Pat. No. 4,340,563 to Appel et al., and U.S. Pat. No. 3,692,618 to Dorschner et al., U.S. Pat. No. 3,802,817 to Matsuki et al., U.S. Pat. Nos. 3,338,992 and 3,341,394 to Kinney, U.S. Pat. No. 3,502,763 to Hartmann, U.S. Pat. No. 3,502,538 to Petersen, and U.S. Pat. No. 3,542,615 to Dobo et al., each of which is incorporated herein in its entirety by reference. Spunbond fibers are quenched and generally not tacky when they are deposited onto a collecting surface. Spunbond fibers are generally continuous and often have average deniers larger than about 0.3, more particularly, between about 0.6 and 10.

"Stretchable" means that a material can be stretched, without breaking, to at least 150% of its initial (unstretched) length in at least one direction, suitably to at least 200% of its initial length, desirably to at least 250% of its initial length.

"Superabsorbent" or "superabsorbent material" refers to a water-swellable, water-insoluble organic or inorganic material capable, under the most favorable conditions, of absorbing at least about 15 times its weight and, more desirably, at least about 30 times its weight in an aqueous solution containing 0.9 weight percent sodium chloride. The superabsorbent materials can be natural, synthetic and modified natural polymers and materials. In addition, the superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds such as cross-linked polymers.

"Surface" includes any layer, film, woven, nonwoven, laminate, composite, or the like, whether pervious or impervious to air, gas, and/or liquids.

"Thermoplastic" describes a material that softens when exposed to heat and which substantially returns to a nonsoftened condition when cooled to room temperature.

These terms may be defined with additional language in the remaining portions of the specification.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

Referring to FIG. 1, a laminate **10** is shown including an elastic nonwoven web layer **12** and a barrier film layer **14**. Due to separation between the elastic layer **12** and the film layer **14**, the laminate **10** can freely stretch and can maintain a wide range of breathability. The elastic layer **12** has a cloth-like texture and can include a neck-bonded laminate or a stretch-bonded laminate. Methods of making such materials are well known to those skilled in the art and described in U.S. Pat. No. 5,226,992 issued Jul. 13, 1993 to Morman; and European Patent Application No. EP 0 217 032 published on Apr. 8, 1987 in the names of Taylor et al.; both of which are incorporated herein by reference. Other suitable elastic nonwoven materials include a spunbond-meltblown-spunbond laminate, another spunbonded laminate, or another meltblown laminate.

Other materials suitable for use in preparing the elastic nonwoven web **12** include diblock, triblock, or multi-block elastomeric copolymers such as olefinic copolymers, including styrene-isoprene-styrene, styrene-butadiene-styrene, styrene-ethylene/butylene-styrene, or styrene-ethylene/propylene-styrene, which may be obtained from the Shell Chemical Company, under the trade designation KRATON® elastomeric resin; polyurethanes, including those available from E. I. Du Pont de Nemours Co., under the trade name LYCRA® polyurethane; polyamides, including polyether block amides available from Ato Chemical Company, under the trade name PEBAX® polyether block amide; polyesters, such as those available from E.I. Du Pont de Nemours Co., under the trade name HYTREL® polyester; and single-site or metallocene-catalzed polyolefins having density less than about 0.89 grams/cc, available from Dow Chemical Co. under the trade name AFFINITY®. Other suitable elastomeric polymers may also be used to make the elastic nonwoven web **12**. These include, without limitation, elastomeric (single-site or metallocene catalyzed) polypropylene, polyethylene and other alpha-olefin homopolymers and copolymers, having density less than about 0.89 grams/cc; ethylene vinyl acetate copolymers; and substantially amorphous copolymers and terpolymers of ethylene-propylene, butene-propylene, and ethylene-propylene-butene.

The film layer **14** is microporous and has minimal stretch. Breathability of the film layer **14** can vary greatly, and is suitably at least 500 grams/M^2-24 hours, more suitably at least 1000 grams/m^2-24 hours, desirably at least 5000 grams/m^2-24 hours, determined from the WVTR test procedure described below. The microporous quality of the film layer **14** readily permits molecular diffusion of moisture vapor between a first surface **16** of the film layer **14** and a second surface **18** of the film layer **14**. Suitable materials for the film layer **14** include polyolefin films and any other suitable polymeric films that are liquid impermeable and vapor permeable.

One particular material suitable for the film layer **14** is a self-regulating film that includes a polymer matrix component and a water-swellable filler component. The polymer matrix preferably includes a polyolefin, and constitutes about 30–90% by weight of the film layer. The self-

regulating film layer **14** also includes a filler component that can be water-swellable and/or non-water-swellable. The filler component may be an organic or inorganic filler, and constitutes about 10–70% by weight of the film layer **14**. The filler(s) and polymer matrix component are initially melt blended, and the blend is extruded into a precursor film layer. The precursor film layer may be extruded as a single-layer film, or may constitute one or more layers in a multilayer film structure. The film is then stretched at an elevated temperature below the melting temperature of the polymer component. As the film is stretched, voids form around the filler particles to form a microporous, breathable self-regulating film layer **14**.

The self-regulating film layer **14** functions as a typical microporous breathable film during times of low to moderate moisture exposure. The voided film is characterized by thin polymer membranes surrounding the filler particles, and/or fine pore networks, either of which creates a tortuous path so that the film allows the molecular diffusion of water vapor through the film, but does not allow penetration by liquid water. When the vapor penetration becomes excessive, such as when one side of the film is exposed to a saturated or otherwise high vapor concentration or an aqueous liquid, the water-swellable filler particles become wet from condensation and begin to swell, filling the voids to various degrees. By this mechanism, the vapor permeable tortuous paths are reduced or closed off.

The film layer **14** and the elastic layer **12** are partially, but not fully, bonded to one another. For example, if the film layer **14** and the elastic layer **12** have the same length and the same width and are aligned with one another, the two layers can be bonded together about a periphery of each of the layers. If, however, one layer is smaller than the other, the two layers can be bonded together about a periphery of the smaller layer, or about a periphery of a union of the two layers. Alternatively, the two layers can be bonded together in a pattern that allows each layer enough freedom to stretch or move on its own without causing the other layer to move.

Minimal bonding is used to bond the film layer **14** to the elastic layer **12**. At least 70% of the bonding is in a peripheral region of at least one of the layers **12, 14**. The term "peripheral region" as used herein refers to a region along the periphery of a layer suitably within about 1.5 inches (3.8 cm) of an edge of the layer, desirably within about 0.5 inch (1.3 cm) of an edge of the layer. Desirably, at least 80% of the bonding is in the peripheral region of at least one of the layers **12, 14**. More desirably, at least 90% of the bonding is in the peripheral region of at least one of the layers **12, 14**. Even 100% of the bonding can suitably be in the peripheral region of at least one of the layers **12, 14**. The minimal bonding allows the elastic layer **12** and the film layer **14** to move independently to conform to a wearer's needs, thereby providing great flexibility to improve fit, thus reducing the possibility of leakage. Furthermore, because of the large unbonded region between the film layer **14** and the elastic layer **12**, breathability of the film layer **14** is not restricted by the elastic layer **12**.

The film layer **14** and the elastic layer **12** can be bonded to one another either adhesively or sonically. Suitable laminate adhesives, which can be applied continuously or intermittently as beads, a spray, parallel swirls, or the like, can be obtained from Findley Adhesives, Inc., of Wauwatosa, Wis., U.S.A., or from National Starch and Chemical Company, Bridgewater, N.J., U.S.A. Examples of suitable adhesives include elastomeric adhesives (i.e. materials capable of at least 75% elongation without rupture), such as aqueous-based styrene butadiene adhesives, neoprene, polyvinyl chloride, vinyl copolymers, polyamides, and ethylene vinyl terpolymers.

The laminate **10** of the invention is particularly suitable for use as an outer cover for any suitable disposable absorbent article. Examples of such suitable articles include diapers, training pants, swim wear, adult incontinence garments, feminine hygiene products, other personal care or health care garments, or the like. The use of the laminate **10** as an outer cover for any of these products improves the fit of the product by providing elastic conformability to the entire outer cover, and also improves air circulation through the product through the use of a highly breathable film layer **14**.

Referring to FIG. **2**, a disposable absorbent article, such as a training pant **20**, is illustrated in a partially fastened condition. The training pant **20** includes an absorbent chassis **32**, which includes the laminate **10** as an outer cover **40**.

The absorbent chassis **32** defines a front region **22**, a back region **24**, a crotch region **26** interconnecting the front and back regions, an inner surface **28** which is configured to contact the wearer, and an outer surface **30** opposite the inner surface which is configured to contact the wearer's clothing. With additional reference to FIGS. **3** and **4**, the absorbent chassis **32** also defines a pair of transversely opposed side edges **36** and a pair of longitudinally opposed waist edges, which are designated front waist edge **38** and back waist edge **39**. The front region **22** is contiguous with the front waist edge **38**, and the back region **24** is contiguous with the back waist edge **39**.

The illustrated absorbent chassis **32** includes a generally rectangular composite structure **33**, a pair of transversely opposed front side panels **34**, and a pair of transversely opposed back side panels **134**. The composite structure **33** and side panels **34** and **134** may be integrally formed or may include two or more separate elements, as shown in FIGS. **2–4**. The illustrated composite structure **33** includes an outer cover **40**, a bodyside liner **42** which is connected to the outer cover in a superposed relation, an absorbent assembly **44** (FIG. **4**) which is located between the outer cover **40** and the bodyside liner **42**, and a pair of containment flaps **46** (FIG. **4**). The generally rectangular composite structure **33** has opposite linear end edges **45** that form portions of the front and back waist edges **38** and **39**, and opposite linear side edges **47** that form portions of the side edges **36** of the absorbent chassis **32** (FIGS. **3** and **4**). For reference, arrows **48** and **49** depicting the orientation of the longitudinal axis and the transverse axis, respectively, of the training pant **20** are illustrated in FIGS. **3** and **4**.

With the training pant **20** in the fastened position as partially illustrated in FIG. **2**, the front and back regions **22** and **24** are joined together to define a three-dimensional pant configuration having a waist opening **50** and a pair of leg openings **52**. The front region **22** includes the portion of the training pant **20** which, when worn, is positioned on the front of the wearer while the back region **24** includes the portion of the training pant which, when worn, is positioned on the back of the wearer. The crotch region **26** of the training pant **20** includes the portion of the training pant which, when worn, is positioned between the legs of the wearer and covers the lower torso of the wearer. The front and back side panels **34** and **134** include the portions of the training pant **20** which, when worn, are positioned on the hips of the wearer.

The outer cover **40** includes the laminate **10** of the invention. The elastic layer **12** provides a generally cloth-like texture for an outer surface of the outer cover. As mentioned, the elastic layer **12** can include a neck-bonded laminate, a stretch-bonded laminate, a spunbond-

meltblown-spunbond laminate, a spunbonded laminate, or a meltblown laminate. One example of such a material is a 20 gsm (grams per square meter) spunbond polypropylene nonwoven web.

The film layer **14** of the laminated outer cover **40** is substantially liquid impermeable, can have any of a wide range of breathability, and has minimal stretchability. The film layer **14** is desirably manufactured from a thin plastic film and prevents waste material from wetting articles, such as bedsheets and clothing, as well as the wearer and care giver. A suitable liquid impermeable film for use as the film layer **14** is a 0.2 millimeter polyethylene film commercially available from Huntsman Packaging of Newport News, Va., U.S.A. The liquid impermeable film layer **14** can permit vapors to escape from the interior of the disposable absorbent article **20**, while still preventing liquids from passing through the outer cover **40**. A suitable "breathable" material is composed of a microporous polymer film or a nonwoven fabric that has been coated or otherwise treated to impart a desired level of liquid impermeability. A suitable microporous film is a PMP-1 film material commercially available from Mitsui Toatsu Chemicals, Inc., Tokyo, Japan, or an XKO-8044 polyolefin film commercially available from 3M Company, Minneapolis, Minn.

As in the laminate **10** alone, the elastic layer **12** and the film layer **14**, when used as the outer cover **40**, are partially bonded to one another. For example, the elastic layer **12** and the film layer **14** can be bonded to one another around the waist opening **50** and the leg openings **52** of the garment. Additional bonding may be included as well.

The front region **22** of the absorbent chassis **32** includes the transversely opposed front side panels **34** and a front center panel **35** (FIGS. **3** and **4**) positioned between and interconnecting the side panels, along with a front waist elastic member **54** and any other connected components. The back region **24** of the absorbent chassis **32** includes the transversely opposed back side panels **134** and a back center panel **135** (FIGS. **3** and **4**) positioned between and interconnecting the side panels, as well as a rear waist elastic member **56** and any other connected components. The waist edges **38** and **39** of the absorbent chassis **32** are configured to encircle the waist of the wearer when worn and provide the waist opening **50** which defines a waist perimeter dimension. Portions of the transversely opposed side edges **36** in the crotch region **26** generally define the leg openings **52**.

The transversely opposed front side panels **34** and transversely opposed back side panels **134** can be permanently bonded to the composite structure **33** of the absorbent chassis **32** in the respective front and back regions **22** and **24**, and are releasably attached to one another by a fastening system **80**. More particularly, as shown best in FIGS. **3** and **4**, the front side panels **34** can be permanently bonded to and extend transversely beyond the linear side edges **47** of the composite structure **33** in the front region **22** along attachment lines **66**, and the back side panels **134** can be permanently bonded to and extend transversely beyond the linear side edges of the composite structure in the back region **24** along attachment lines **66**. The side panels **34** and **134** may be attached using attachment means known to those skilled in the art such as adhesive, thermal or ultrasonic bonding. The side panels **34** and **134** can also be formed as extensions of the outer cover **40**.

The absorbent chassis **32** is configured to contain and/or absorb any body exudates discharged from the wearer. For example, the absorbent chassis **32** desirably although not necessarily includes the pair of containment flaps **46** which are configured to provide a barrier to the transverse flow of body exudates. A flap elastic member **53** (FIG. **4**) is operatively joined with each containment flap **46** in any suitable manner as is well known in the art. The elasticized containment flaps **46** define an unattached edge which assumes an upright, generally perpendicular configuration in at least the crotch region **26** of the training pant **20** to form a seal against the wearer's body. The containment flaps **46** can be located along the transversely opposed side edges **36** of the absorbent chassis **32**, and can extend longitudinally along the entire length of the absorbent chassis or may only extend partially along the length of the absorbent chassis. Suitable constructions and arrangements for the containment flaps **46** are generally well known to those skilled in the art and are described in U.S. Pat. No. 4,704,116 issued Nov. 3, 1987 to Enloe, which is incorporated herein by reference.

To further enhance containment and/or absorption of body exudates, the training pant **20** desirably includes the front waist elastic member **54**, the rear waist elastic member **56**, and leg elastic members **58**, as are known to those skilled in the art (FIG. **4**). The waist elastic members **54** and **56** can be operatively joined to the outer cover **40** and/or bodyside liner **42** along the opposite waist edges **38** and **39**, and can extend over part or all of the waist edges. The waist elastic members **54** and **56** can be relaxed or partially elongated when joined to the outer cover **40** and/or bodyside liner **42**, thereby resulting in a high performance effect.

The leg elastic members **58** are desirably operatively joined to the outer cover **40** and/or bodyside liner **42** along the opposite side edges **36** and positioned in the crotch region **26** of the training pant **20**. The leg elastic members **58** are desirably longitudinally aligned along each side edge **47** of the composite structure **33**.

The flap elastic members **53**, the waist elastic members **54** and **56**, and the leg elastic members **58** can be formed of any suitable elastic material. As is well known to those skilled in the art, suitable elastic materials include sheets, strands or ribbons of natural rubber, synthetic rubber, or thermoplastic elastomeric polymers. The elastic materials can be stretched and adhered to a substrate, adhered to a gathered substrate, or adhered to a substrate and then elasticized or shrunk, for example with the application of heat; such that elastic constrictive forces are imparted to the substrate. In one particular embodiment, for example, the leg elastic members **58** include a plurality of dry-spun coalesced multifilament spandex elastomeric threads sold under the trade name LYCRA® and available from E.I. DuPont de Nemours and Company, Wilmington, Del., U.S.A. In another particular embodiment, the waist elastic members **54** and **56** can be partially elongated when attached to the chassis **32**, such that the waist elastic members **54** and **56** provide a seal around a wearer's waist, yet can also expand along with the elastic layer **12** when the wearer moves.

The liquid permeable bodyside liner **42** is illustrated as overlying the outer cover **40** and absorbent assembly **44**, and may but need not have the same dimensions as the outer cover **40**. The bodyside liner **42** is desirably compliant, soft feeling, and non-irritating to the wearer's skin. Further, the bodyside liner **42** can be less hydrophilic than the absorbent assembly **44**, to present a relatively dry surface to the wearer and permit liquid to readily penetrate through its thickness.

The bodyside liner **42** can be manufactured from a wide selection of web materials, such as synthetic fibers (for example, polyester or polypropylene fibers), natural fibers (for example, wood or cotton fibers), a combination of

natural and synthetic fibers, porous foams, reticulated foams, apertured plastic films, or the like. Various woven and nonwoven fabrics can be used for the bodyside liner **42**. For example, the bodyside liner **42** can be composed of a meltblown or spunbonded web of polyolefin fibers. The bodyside liner **42** can also be a bonded-carded web composed of natural and/or synthetic fibers. The bodyside liner **42** can be composed of a substantially hydrophobic material, and the hydrophobic material can, optionally, be treated with a surfactant or otherwise processed to impart a desired level of wettability and hydrophilicity. For example, the material can be surface treated with about 0.45 weight percent of a surfactant mixture including AHCOVEL® N-62 from Hodgson Textile Chemicals of Mount Holly, N.C., U.S.A. and GLUCOPON® 220UP from Henkel Corporation of Ambler, Pa., in an active ratio of 3:1. The surfactant can be applied by any conventional means, such as spraying, printing, brush coating or the like. The surfactant can be applied to the entire bodyside liner **42** or can be selectively applied to particular sections of the bodyside liner, such as the medial section along the longitudinal centerline.

A suitable liquid permeable bodyside liner **42** is a nonwoven bicomponent web having a basis weight of about 27 gsm. The nonwoven bicomponent can be a spunbond bicomponent web, or a bonded carded bicomponent web. Suitable bicomponent staple fibers include a polyethylene/polypropylene bicomponent fiber available from CHISSO Corporation, Osaka, Japan. In this particular bicomponent fiber, the polypropylene forms the core and the polyethylene forms the sheath of the fiber. Other fiber orientations are possible, such as multi-lobe, side-by-side, end-to-end, or the like.

The absorbent assembly **44** (FIG. **4**) is positioned between the outer cover **40** and the bodyside liner **42**, which components can be joined together by any suitable means, such as adhesives, as is well known in the art. The absorbent assembly **44** can be any structure which is generally compressible, conformable, non-irritating to the child's skin, and capable of absorbing and retaining liquids and certain body wastes. The absorbent assembly **44** can be manufactured in a wide variety of sizes and shapes, and from a wide variety of liquid absorbent materials commonly used in the art. For example, the absorbent assembly **44** can suitably include a matrix of hydrophilic fibers, such as a web of cellulosic fluff, mixed with particles of a high-absorbency material commonly known as superabsorbent material. In a particular embodiment, the absorbent assembly **44** includes a matrix of cellulosic fluff, such as wood pulp fluff, and superabsorbent hydrogel-forming particles. The wood pulp fluff can be exchanged with synthetic, polymeric, meltblown fibers or with a combination of meltblown fibers and natural fibers. The superabsorbent particles can be substantially homogeneously mixed with the hydrophilic fibers or can be nonuniformly mixed. The fluff and superabsorbent particles can also be selectively placed into desired zones of the absorbent assembly **44** to better contain and absorb body exudates. The concentration of the superabsorbent particles can also vary through the thickness of the absorbent assembly **44**. Alternatively, the absorbent assembly **44** can include a laminate of fibrous webs and superabsorbent material or other suitable means of maintaining a superabsorbent material in a localized area.

Suitable superabsorbent materials can be selected from natural, synthetic, and modified natural polymers and materials. The superabsorbent materials can be inorganic materials, such as silica gels, or organic compounds, such as crosslinked polymers. Suitable superabsorbent materials are available from various commercial vendors, such as Dow Chemical Company located in Midland, Mich., U.S.A., and Stockhausen GmbH & Co. KG, D-47805 Krefeld, Federal Republic of Germany. Typically, a superabsorbent material is capable of absorbing at least about 15 times its weight in water, and desirably is capable of absorbing more than about 25 times its weight in water.

In one embodiment, the absorbent assembly **44** is generally rectangular in shape, and includes a blend of wood pulp fluff and superabsorbent material. One preferred type of fluff is identified with the trade designation CR1654, available from U.S. Alliance, Childersburg, Ala., U.S.A., and is a bleached, highly absorbent sulfate wood pulp containing primarily soft wood fibers. As a general rule, the superabsorbent material is present in the absorbent assembly **44** in an amount of from about 5 to about 90 weight percent based on total weight of the absorbent assembly. The absorbent assembly **44** suitably has a density within the range of about 0.10 to about 0.50 grams per cubic centimeter. The absorbent assembly **44** may or may not be wrapped or encompassed by a suitable tissue wrap that maintains the integrity and/or shape of the absorbent assembly.

The absorbent chassis **32** can also incorporate other materials that are designed primarily to receive, temporarily store, and/or transport liquid along the mutually facing surface with the absorbent assembly **44**, thereby maximizing the absorbent capacity of the absorbent assembly. One suitable material is referred to as a surge layer (not shown) and includes a material having a basis weight of about 50 to about 120 grams per square meter, and including a through-air-bonded-carded web of a homogenous blend of 60 percent 3 denier type T-256 bicomponent fiber including a polyester core/polyethylene sheath and 40 percent **6** denier type T-295 polyester fiber, both commercially available from Kosa Corporation of Salisbury, N.C., U.S.A.

In particular embodiments for improved fit and appearance, the side panels **34** and **134** desirably have an average length dimension measured parallel to the longitudinal axis **48** that is about 20 percent or greater, and particularly about 25 percent or greater, of the overall length dimension of the absorbent article **20**, also measured parallel to the longitudinal axis **48**. For example, in training pants having an overall length dimension of about 54 centimeters, the side panels **34** and **134** desirably have an average length dimension of about 10 centimeters or greater, such as about 15 centimeters. While each of the side panels **34** and **134** extend from the waist opening **50** to one of the leg openings **52**, the back side panels **134** have a continually decreasing length dimension moving from the attachment line **66** to a distal edge **68** of the back panel **134**, as is best shown in FIGS. **3** and **4**.

Each of the side panels **34** and **134** can include one or more individual, distinct pieces of material. In particular embodiments, for example, each side panel **34** and **134** can include first and second side panel portions that are joined at a seam, with at least one of the portions including an elastomeric material. Still alternatively, each individual side panel **34** and **134** can include a single piece of material which is folded over upon itself along an intermediate fold line (not shown).

The side panels **34** and **134** desirably include an elastic material, such as the elastic layer **12**, capable of stretching in a direction generally parallel to the transverse axis **49** of the training pant **20**. In particular embodiments, the front and back side panels **34** and **134** may each include an interior portion **78** disposed between the distal edge **68** and

the respective front or back center panel **35** or **135**. In the illustrated embodiment in FIG. **4**, the interior portions **78** are disposed between the distal edges **68** and the side edges **47** of the rectangular composite structure **33**. The elastic material of the side panels **34** and **134** can be disposed in the interior portions **78** to render the side panels elastomeric in a direction generally parallel to the transverse axis **49**. Most desirably, each side panel **34** and **134** is elastomeric from a waist end edge **72** to a leg end edge **70**. More specifically, individual samples of side panel material, taken between the waist end edge **72** and the leg end edge **70** parallel to the transverse axis **49** and having a length from the attachment line **66** to the distal edge **68** and a width of about 2 centimeters, are all elastomeric.

Suitable elastic materials, as well as one described process of incorporating elastic side panels into a training pant, are described in the following U.S. Pat. No. 4,940,464 issued Jul. 10, 1990 to Van Gompel et al.; U.S. Pat. No. 5,224,405 issued Jul. 6, 1993 to Pohjola; U.S. Pat. No. 5,104,116 issued Apr. 14, 1992 to Pohjola; and U.S. Pat. No. 5,046,272 issued Sep. 10, 1991 to Vogt et al.; all of which are incorporated herein by reference. In particular embodiments, the elastic material includes a stretch-thermal laminate, a neck-bonded laminated, a reversibly necked laminate, or a stretch-bonded laminate material. Methods of making such materials are well known to those skilled in the art and described in U.S. Pat. No. 4,663,220 issued May 5, 1987 to Wisneski et al.; U.S. Pat. No. 5,226,992 issued Jul. 13, 1993 to Morman; and European Patent Application No. EP 0 217 032 published on Apr. 8, 1987 in the names of Taylor et al.; all of which are incorporated herein by reference. Alternatively, the side panel material may include other woven or nonwoven materials, such as those described above as being suitable for the outer cover **40** or bodyside liner **42**, or stretchable but inelastic materials.

FIG. **5** illustrates a process for forming the laminate **10** of the invention. Prior to the illustrated process, the elastic nonwoven layer **12** is formed and wound onto a roller **82**. Also, the film layer **14** is extruded and wound onto a roller **84**. As shown in FIG. **5**, the elastic layer **12** is unwound from the roller **82** simultaneously while the film layer **14** is unwound from the roller **84**. The elastic layer **12** and the film layer **14** are then laminated together. Before the elastic layer **12** and the film layer **14** are laminated, a portion of either the elastic layer **12** or the film layer **14** can be coated or sprayed with an adhesive **86** via an adhesive sprayer **88**. The laminate material is then passed through nip rolls **90** (preferably smooth calender rolls) and is relaxed and/or retracted to produce the laminate **10** of the invention. Other means for bonding the laminate material known to those having ordinary skill in the art, such as sonic bonding, may be used in place of the adhesive **86** and the nip rolls **90**. Bonding between the elastic layer **12** and the film layer **14** is preferably minimal, in a range of between about 5% and about 60% of a surface area of each layer is bonded, suitably between about 7% and about 50% of the surface area of each layer is bonded, more suitably, between about 10% and about 25% of the surface area of each layer is bonded.

The resulting laminate **10** may be used in a wide variety of personal care absorbent articles and medical articles. Due to the minimal bonding, the elastic layer **12** and the film layer **14** can move independently to conform to a wearer's needs, thereby providing great flexibility to improve fit, thus reducing the possibility of leakage. Furthermore, breathability of the film layer **14** is not restricted by the elastic layer **12**. The laminate **10** is relatively inexpensive to produce and provides an aesthetically pleasing appearance in finished products attributable to the elastic layer **12** which conforms to the wearer's body.

It will be appreciated that details of the foregoing embodiments, given for purposes of illustration, are not to be construed as limiting the scope of this invention. Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention, which is defined in the following claims and all equivalents thereto. Further, it is recognized that many embodiments may be conceived that do not achieve all of the advantages of some embodiments, particularly of the preferred embodiments, yet the absence of a particular advantage shall not be construed to necessarily mean that such an embodiment is outside the scope of the present invention.

Test Procedure for Water Vapor Transmission Rate (WVTR)

A suitable technique for determining the WVTR (water vapor transmission rate) value of a film or laminate material of the invention is the test procedure standardized by INDA (Association of the Nonwoven Fabrics Industry), number IST-70.4–99, entitled "STANDARD TEST METHOD FOR WATER VAPOR TRANSMISSION RATE THROUGH NONWOVEN AND PLASTIC FILM USING A GUARD FILM AND VAPOR PRESSURE SENSOR" which is incorporated by reference herein. The INDA procedure provides for the determination of WVTR, the permeance of the film to water vapor and, for homogeneous materials, water vapor permeability coefficient.

The INDA test method is well known and will not be set forth in detail herein. However, the test procedure is summarized as follows. A dry chamber is separated from a wet chamber of known temperature and humidity by a permanent guard film and the sample material to be tested. The purpose of the guard film is to define a definite air gap and to quiet or still the air in the air gap while the air gap is characterized. The dry chamber, guard film, and the wet chamber make up a diffusion cell in which the test film is sealed. The sample holder is known as the Permatran-W Model 100K manufactured by Mocon/Modern Controls, Inc., Minneapolis, Minn. A first test is made of the WVTR of the guard film and the air gap between an evaporator assembly that generates 100% relative humidity. Water vapor diffuses through the air gap and the guard film and then mixes with a dry gas flow which is proportional to water vapor concentration. The electrical signal is routed to a computer for processing. The computer calculates the transmission rate of the air gap and the guard film and stores the value for further use.

The transmission rate of the guard film and air gap is stored in the computer as CalC. The sample material is then sealed in the test cell. Again, water vapor diffuses through the air gap to the guard film and the test material and then mixes with a dry gas flow that sweeps the test material. Also, again, this mixture is carried to the vapor sensor. The computer than calculates the transmission rate of the combination of the air gap, the guard film, and the test material. This information is then used to calculate the transmission rate at which moisture is transmitted through the test material according to the equation:

$$TR^{-1}_{test\ material} = TR^{-1}_{test\ material,guardfilm,airgap} - TR^{-1}_{guardfilm,airgap}$$

Calculations:

WVTR: The calculation of the WVTR uses the formula:

$$WVTR=Fp_{sat}(T)RH/Ap_{sat}(T)(1-RH))$$

where:

F=The flow of water vapor in cc/min.,

$p_{sat}(T)$=The density of water in saturated air at temperature T,

RH=The relative humidity at specified locations in the cell,

A=The cross sectional area of the cell, and,

$p_{sat}(T)$=The saturation vapor pressure of water vapor at temperature T.

We claim:

1. A laminate comprising:

an elastic nonwoven layer having a length and a width, and a barrier film having a length and a width substantially equal to the length and the width of the elastic nonwoven layer, the barrier film aligned with and partially bonded to the elastic nonwoven layer, wherein at least 70% of a bonded area is located in a peripheral region of each of the layers, the peripheral region surrounding an unbonded central region.

2. The laminate of claim 1, wherein at least 80% of the bonded area is located in the peripheral region of at least one of the layers.

3. The laminate of claim 1, wherein at least 90% of the bonded area is located in the peripheral region of at least one of the layers.

4. The laminate of claim 1, wherein roughly 100% of the bonded area is located in the peripheral region of at least one of the layers.

5. The laminate of claim 1, wherein the barrier film has a WVTR of at least about 500 grams/m^2-24 hours.

6. The laminate of claim 1, wherein the barrier film has a WVTR of at least about 1000 grams/m^2-24 hours.

7. The laminate of claim 1, wherein the barrier film has a WVTR of at least about 5000 grams/m^2-24 hours.

8. The laminate of claim 1, wherein the elastic nonwoven layer comprises a neck-bonded laminate.

9. The laminate of claim 1, wherein the elastic nonwoven layer comprises a stretch-bonded laminate.

10. The laminate of claim 1, wherein the elastic nonwoven layer comprises a spunbond-meltblown-spunbond laminate.

11. The laminate of claim 1, wherein the elastic nonwoven layer comprises a spunbonded laminate.

12. The laminate of claim 1, wherein the elastic nonwoven layer comprises a meltblown laminate.

13. An absorbent garment comprising:

a chassis having a liquid-permeable bodyside liner, an absorbent core, and a substantially liquid-impermeable outer cover, the chassis defining a pair of leg openings and a waist opening;

wherein the outer cover includes a laminate comprising an elastic nonwoven outer layer having a length and a width, and a barrier film inner layer having a length and a width substantially equal to the length and the width of the outer layer, the inner layer aligned with and partially bonded to the elastic nonwoven outer layer such that at least 70% of a bonded area is located in a peripheral region of each of the layers, the peripheral region surrounding an unbonded central region.

14. The absorbent garment of claim 13, wherein at least 80% of the bonded area is located in the peripheral region of at least one of the layers.

15. The absorbent garment of claim 13, wherein at least 90% of the bonded area is located in the peripheral region of at least one of the layers.

16. The absorbent garment of claim 13, wherein roughly 100% of the bonded area is located in the peripheral region of at least one of the layers.

17. The absorbent garment of claim 13, wherein the barrier film inner layer has a WVTR of at least about 500 grams/m^2-24 hours.

18. The absorbent garment of claim 13, wherein the barrier film inner layer has a WVTR of at least about 1000 grams/m^2-24 hours.

19. The absorbent garment of claim 13, wherein the barrier film inner layer has a WVTR of at least about 5000 grams/m^2-24 hours.

20. The absorbent garment of claim 13, further comprising an elastic waistband attached to the chassis around the waist opening.

21. The absorbent garment of claim 20, wherein the elastic waistband is partially elongated when attached to the chassis.

22. The absorbent garment of claim 13, comprising a diaper.

23. The absorbent garment of claim 13, comprising swim wear.

24. The absorbent garment of claim 13, comprising child training pants.

25. The absorbent garment of claim 13, comprising an adult incontinence garment.

26. A method of preparing a laminate with independently movable layers, comprising the steps of:

extruding a film layer, the film layer having a length and a width;

providing an elastic nonwoven layer having a length and a width substantially equal to the length and the width of the film layer;

aligning the elastic nonwoven layer with the film layer; and

partially bonding the elastic nonwoven layer to the film layer such that at least 70% of a bonded area is located in a peripheral region of each of the layers, leaving a central region of each layer unbonded.

27. The method of claim 26, wherein at least 80% of the bonded area is located in the peripheral region of at least one of the layers.

28. The method of claim 26, wherein at least 90% of the bonded area is located in the peripheral region of at least one of the layers.

29. The method of claim 26, wherein roughly 100% of the bonded area is located in the peripheral region of at least one of the layers.

30. The method of claim 26, wherein between about 5% and about 60% of a surface of the elastic nonwoven layer is bonded to a surface of the film layer.

31. The method of claim 26, wherein between about 7% and about 50% of a surface of the elastic nonwoven layer is bonded to a surface of the film layer.

32. The method of claim 26, wherein between about 10% and about 25% of a surface of the elastic nonwoven layer is bonded to a surface of the film layer.

* * * * *

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(12) **United States Patent**
Mishima et al.

(10) **Patent No.: US 6,436,083 B1**
(45) **Date of Patent: Aug. 20, 2002**

(54) **DISPOSABLE DIAPER**

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(73) Assignee: **Uni-Charm Corporation,** Ehime-ken (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 109 days.

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(52) **U.S. Cl.** **604/385.24**; 604/385.22; 604/385.27
(58) **Field of Search** 604/385.01, 385.16, 604/385.22, 385.24, 385.27

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(57) **ABSTRACT**

Here is disclosed a disposable diaper improved to be easily put on the wearer. Top- and backsheets in front and rear waist regions of the diaper includes the top- and backsheets that have an elastic stretchability transversely of the diaper, and transversely opposite side edges of the diaper includes top- and backsheets intended to surround the wearer's legs having elastic stretchability longitudinally and transversely of the diaper.

6 Claims, 4 Drawing Sheets

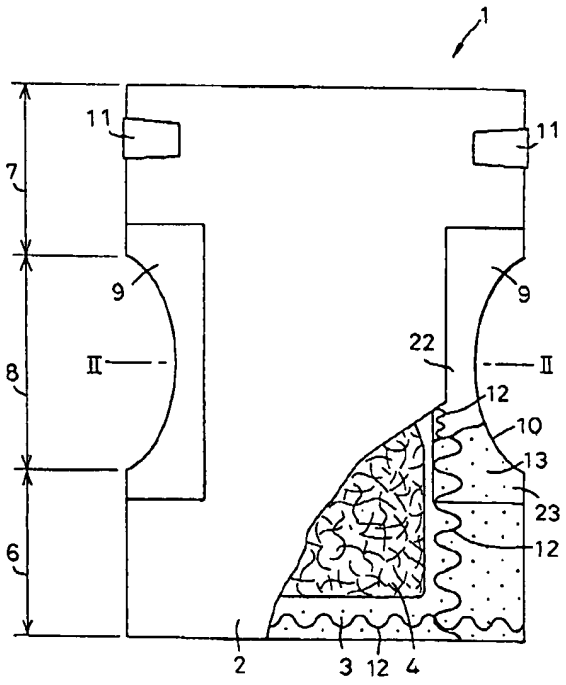

FIG.1

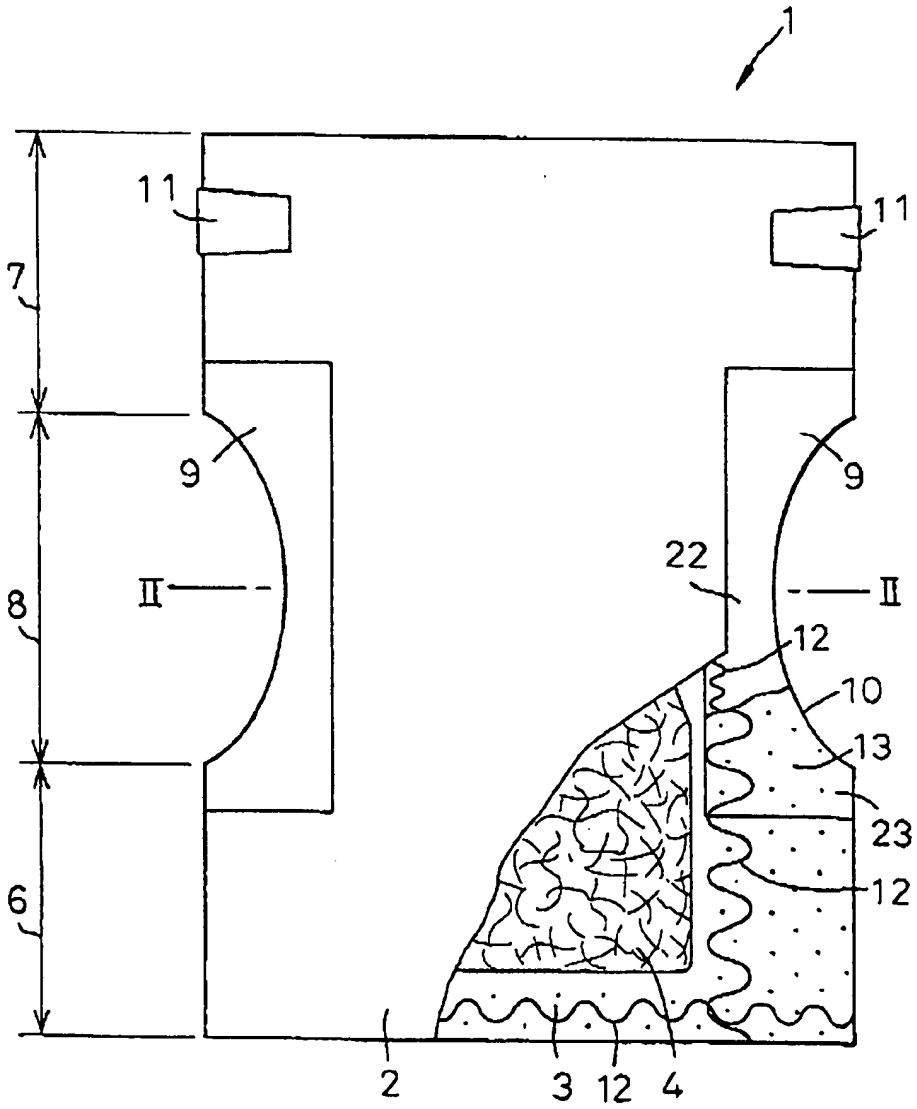

FIG.2

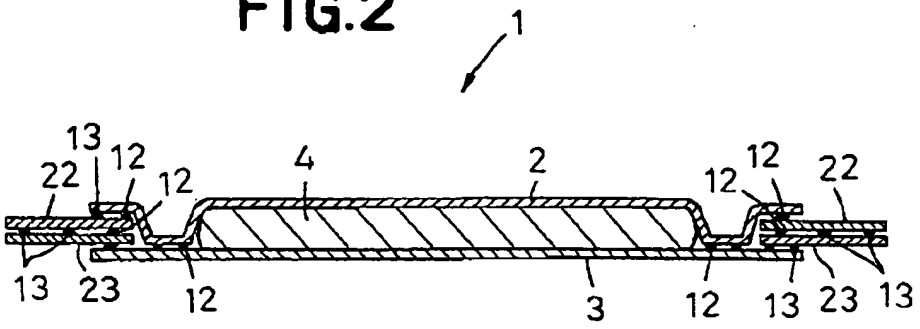
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FIG.3

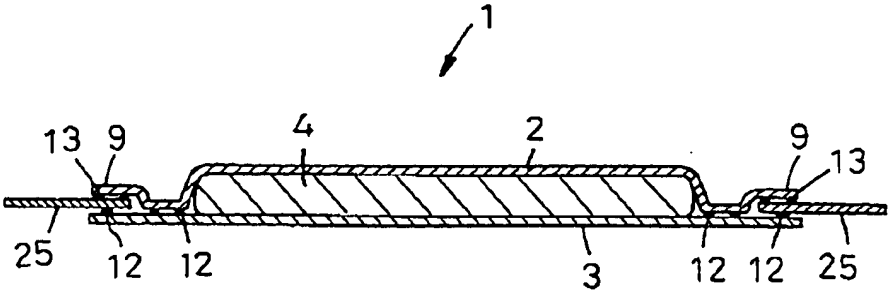
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FIG.4

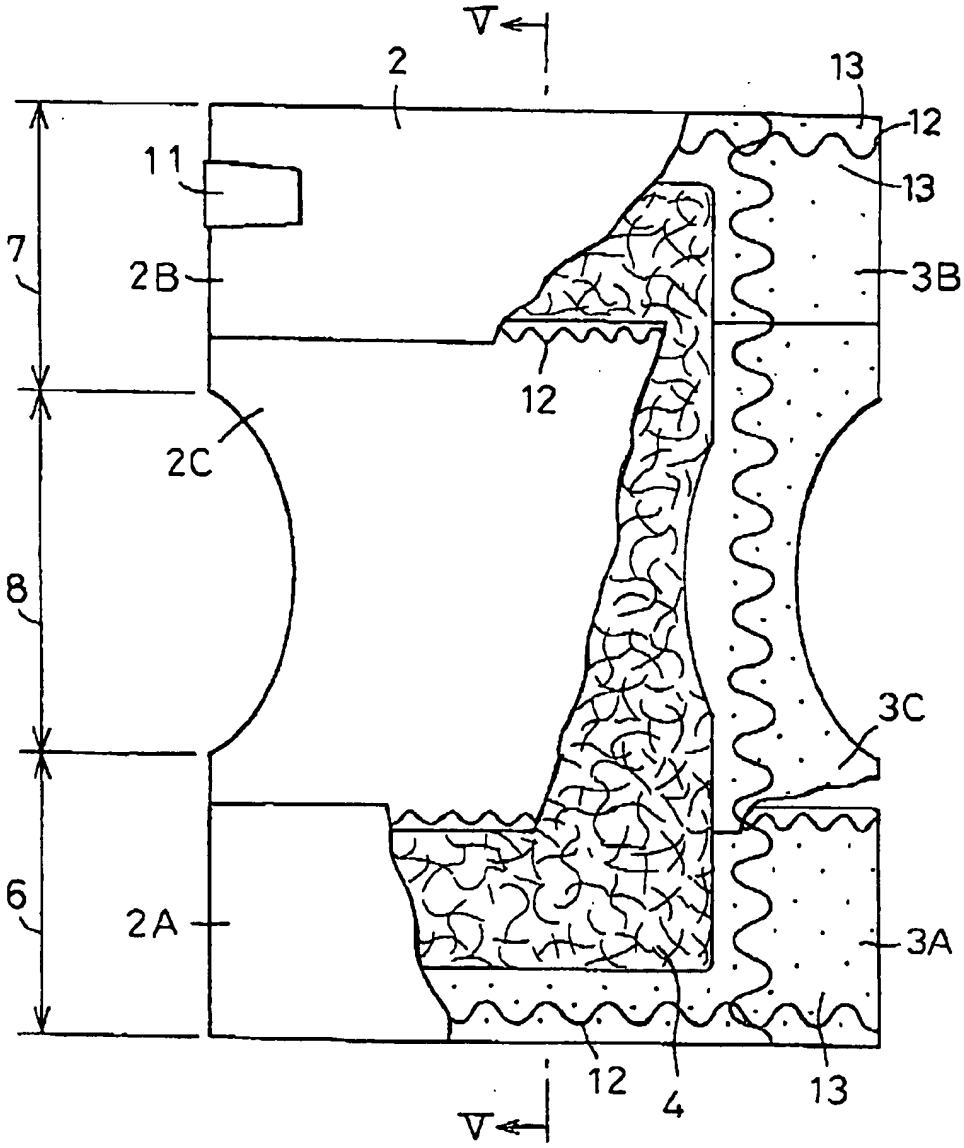
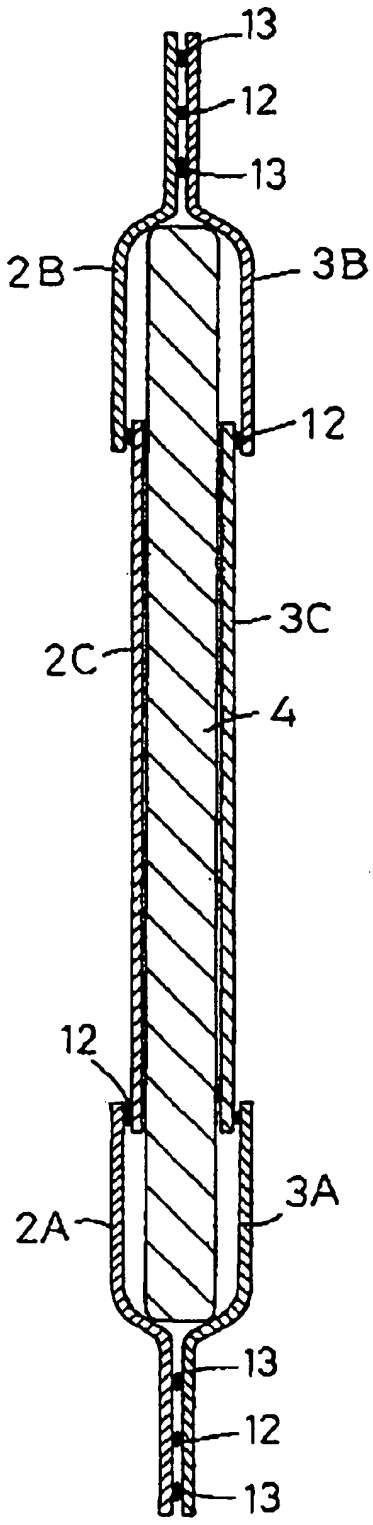


FIG.5



DISPOSABLE DIAPER

BACKGROUND OF THE INVENTION

This invention relates to a disposable diaper for absorbing and containing body wastes.

It is well known to use an elastically non-stretchable nonwoven fabric or a plastic film as stock materials for top- and backsheets of a disposable diaper and to provide the diaper along peripheral edges of the waist-opening and the leg-openings with elastic members secured under an appropriate tension to the diaper so that gathers may be formed along these peripheral edges as the elastic members contract and thereby ensure a good fit of the diaper around the waist and the legs of the wearer.

The diaper of prior art is normally in its shrinked state under contraction of the elastic members and immediately before the diaper is put on the wearer, much time and trouble are required to stretch the gathers so that the waist-opening as well as the leg-openings may be sufficiently widened to facilitate putting the diaper on the wearer. The diaper of prior art is inconvenient also in that when the diaper put on the wearer it is not necessarily able to follow complex movements and therefore is apt to slip down or to become twisted. This is because the diaper is stretchable only in the direction along which the elastic members extend.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a disposable diaper designed so that time and trouble otherwise taken to stretch the gathers in order to put the diaper on the wearer may be eliminated and the diaper may follow movement of the wearer as closely as possible.

According to this invention, there is provided a disposable diaper comprising a topsheet intended to come in contact with the wearer's skin, a backsheet intended to come in contact with the wearer's garment and an absorbent core disposed between the topsheet and the backsheet wherein, the diaper has a front waist region, a rear waist region and a crotch region extending between the waist regions so that transversely opposite side edges of the crotch region surround the wearer's legs, wherein:

the topsheet and the backsheet in the front and rear waist regions are elastically stretchable in a transverse direction of the diaper while the topsheet and the backsheet at the transversely opposite side edges of the crotch region are elastically stretchable in a longitudinal direction of the diaper and in the transverse direction and the topsheet and the backsheet in the remaining regions are elastically stretchable at least in the transverse direction.

The disposable diaper according to the invention has no gathers and facilitates the diaper to be put on the wearer. The diaper according to this invention does not obstruct a movement of the wearer's legs and crotch region because the regions around the legs as well as the crotch region of the diaper are elastically stretchable longitudinally and transversely of the diaper.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially cutaway plan view showing a disposable diaper according to one embodiment of this invention;

FIG. 2 is a sectional view taken along line II—II in FIG. 1;

FIG. 3 is a view similar to FIG. 2 but showing another embodiment of this invention;

FIG. 4 is a view similar to FIG. 1 but showing still another embodiment of this invention; and

FIG. 5 is a sectional view taken along line V—V in FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Details of a disposable diaper according to this invention will be more fully understood from the description given hereunder with reference to the accompanying drawings.

FIG. 1 is a partially cutaway plan view showing a disposable diaper 1 and FIG. 2 is a sectional view taken along line II—II in FIG. 1. The diaper 1 comprises a liquid-previous topsheet 2 intended to come in contact with the wearer's skin, a liquid-impervious backsheet 3 intended to come in contact with the wearer's garment and a liquid-absorbent core 4 disposed between these two sheets 2, 3. Longitudinally, the diaper 1 has a front waist region 6, a rear waist region 7 and a crotch region 8 extending between these two waist regions 6, 7. The crotch region 8 has its transversely opposite side edges 9, 9 partially cut away to form curved edges 10, 10 adapted to fit around the wearer's legs. The rear waist region 7 is provided on its transversely opposite side edges with tape fasteners 11, 11, respectively. The top- and backsheets 2, 3 are placed upon and joined to each other by means of hot melt adhesive 12 along their portions extending outward beyond a peripheral edge of the core 4.

In such diaper 1, both the top- and backsheets 2, 3 are elastically stretchable in the transverse direction which is orthogonal to the longitudinal direction of the diaper 1. It should be understood here that, in the vicinity of the side edges 9, 9 of the crotch region 8, the top- and backsheets 2, 3 are partially cut away and these portions of the sheets 2, 3 thus cut away are replaced by separate top- and backsheets 22, 23 both associated with the leg openings. These top- and backsheets 22, 23 are elastically stretchable longitudinally as well as transversely of the diaper 1. The topsheet 22 associated with the leg-openings is preferably sweat-absorbent and breathable while said backsheet 23 associated with the leg-openings is preferably breathable and liquid-impervious. These top- and backsheets 22, 23 are bonded to the respective inner surface of the top- and backsheet 2, 3, for example, by means of hot melt adhesive 12 applied thereon in a pattern of sine curves. The top- and backsheets 22, 23 associated with the leg-openings are also placed upon and joined to each other by means of hot melt adhesive 13 applied thereon in a pattern of sine curves or small dots (see FIG. 1).

The diaper 1 can be put on the wearer merely by unfolding it as seen in FIG. 1. This diaper 1 is free from the gathers as in the conventional diaper and therefore can be put on the wearer immediately after the diaper 1 has been unfolded without time and trouble taken to stretch the gathers. The top- and backsheets 2, 3 may be circumferentially stretched to put the diaper 1 on the wearer with a good fit. The diaper 1 put on the wearer does not obstruct a movement of baby's legs because the portion of diaper 1 extending around the wearer's legs is free to be stretched in all directions.

FIG. 3 is a view similar to FIG. 2 but showing another embodiment of this invention. According to this embodiment of diaper 1, the crotch region 8 is provided along each of its side edges 9 with a single sheet 25 associated with the leg-opening bonded to the respective inner surfaces of the top- and backsheets 2, 3 by means of hot melt adhesive 12, 13. This single sheet 25 associated with the leg-opening

serves both as the top- and backsheets **22, 23** associated with the leg-openings in the embodiment shown in FIG. **2**.

FIGS. **4** and **5** are respectively a view similar to FIG. **1** but showing still another embodiment of this invention and a sectional view taken along line V—V in FIG. **4**. According to this embodiment of diaper **1**, the topsheet **2** is divided into topsheet sections **2A, 2B** for the front and rear waist regions and a topsheet section **2C** for the crotch region. Similarly, the backsheet **3** is divided into backsheet sections **3A, 3B** and a backsheet section **3C** for the crotch region. The topsheet sections **2A, 2B** for the front and rear waist regions as well as the backsheet sections **3A, 3B** for the front and rear waist regions are elastically stretchable transversely of the diaper **1**. The topsheet sections **2C, 3C** for the crotch region are elastically stretchable longitudinally as well as transversely of the diaper **1**. These sheet sections **2A—2C** and **3A–3C** are bonded one to another along their overlapping zones by means of hot melt adhesive **12, 13** applied thereto in a pattern of sine curves or small dots. Referring to FIG. **5**, the core **4** may be appropriately joined to the respective inner surfaces of the top- and backsheet sections **2A–2C** and **3A—3C** in the front and rear waist regions **6, 7** and in the crotch region **8**. Similarly to the diaper **1** of FIG. **1**, the diaper **1** according to this embodiment also can be easily put on the wearer and the diaper **1** having been put on the wearer does not obstruct a movement of the wearer legs as well as the wearer's crotch.

To make the diaper **1** according to this invention, a nonwoven fabric or an elastomer film having a monoaxial stretchability can be used as stock material for the top- and backsheets or their sections **2, 2A, 2B, 3, 3A, 3B**. Such nonwoven fabric or elastomer may be formed with a plurality of pores each having an appropriate size to obtain a desired liquid-previous property. A nonwoven fabric or an elastomer having a biaxial stretchability can be used as stock material for the top- and backsheet sections **22, 23** associated with the leg-openings, the single sheet **25** associated with each of the leg-openings and the top- and backsheet sections **2C, 3C** of the crotch region. Bonding of such nonwoven fabric and film may be carried out using suitable adhesive agents such as hot melt adhesive or ultrasonic- or heat-sealing technique. It is important to perform operation of sheet-to-sheet bonding without deteriorating the original stretchability of these sheets. When adhesive agent is used, these sheets may be applied with adhesive agent in a pattern of sine curves to avoid an apprehensive deterioration of the sheets' original stetchability and at the same time to prevent the body fluids from flowing between the top- and bakcsheets **2, 3** from the core **4** toward the peripheral edge of the diaper **1**.

What is claimed is:

1. A disposable diaper having a longitudinal direction and a transverse direction and comprising:

a topsheet;

a backsheet; and

an absorbent core disposed between said topsheet and said backsheet,

said diaper further having a front waist region, a rear waist region and a crotch region extending between said front and rear waist regions so that transversely opposite side edges of said crotch region surround a wearer's legs;

portions of said topsheet and said backsheet in said front and rear waist regions being elastically stretchable in said transverse direction;

each portion of said topsheet and said backsheet at said transversely opposite side edges of said crotch region being formed with at least one side sheet material which is different and separate from a material which forms said topsheet and backsheet, said at least one side sheet material being elastically stretchable in said longitudinal direction and transverse direction and being joined to transverse opposite side edges of said topsheet and said backsheet; and

remaining portions of said topsheet and said backsheet being elastically stretchable at least in said transverse direction.

2. The diaper according to claim **1**, wherein said topsheet and said backsheet in said crotch region have transversely opposite side edges thereof partially cut away and said at least one side sheet is joined along between edges of each portion of said topsheet and said backsheet which are cut away at said transversely opposite side edges of said diaper.

3. The diaper according to claim **2**, wherein said side sheet joined along each of said cut away portions comprises a liquid-impermeable single sheet.

4. The diaper according to claim **2**, wherein said side sheet joined along and between each of said cut away portions comprises a breathable upper sheet and a liquid-impervious lower sheet joined on a lower surface of said upper sheet.

5. The diaper according to claim **1**, wherein said topsheet and said backsheet are elastically stretchable in said longitudinal and transverse directions throughout said crotch region.

6. The diaper according to claim **1**, wherein said front and rear waist regions are ungathered.

* * * * *

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Roessler et al.

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(45) **Date of Patent: Apr. 22, 2003**

(54) **ABSORBENT ARTICLE HAVING AN EXTENSIBLE OUTER COVER AND AN EXTENSIBLE BODYSIDE LINER**

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(21) Appl. No.: **09/563,417**

(22) Filed: **May 3, 2000**

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(52) **U.S. Cl.** **604/367**; 604/370; 604/385.22
(58) **Field of Search** 604/385.01, 385.22, 604/385.23, 367, 378, 384, 370

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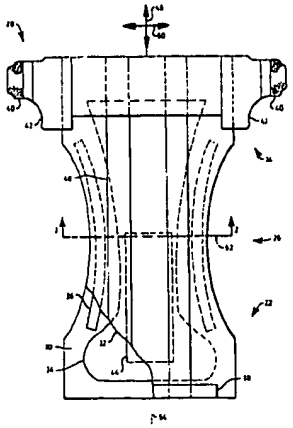
Primary Examiner—Aaron J. Lewis
Assistant Examiner—Jacqueline F Stephens
(74) *Attorney, Agent, or Firm*—Jeffrey B. Curtin; Alyssa A. Dudkowski

(57) **ABSTRACT**

A disposable absorbent article is provided which includes a substantially liquid-impermeable, extensible outer cover, a liquid permeable, extensible bodyside liner, and an absorbent body located between the outer cover and the bodyside liner. The extensible outer cover and extensible bodyside liner can be configured to provide a substantially permanent deformation of at least about 10 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to the Material Elongation and Deformation Tensile Test set forth herein.

30 Claims, 6 Drawing Sheets



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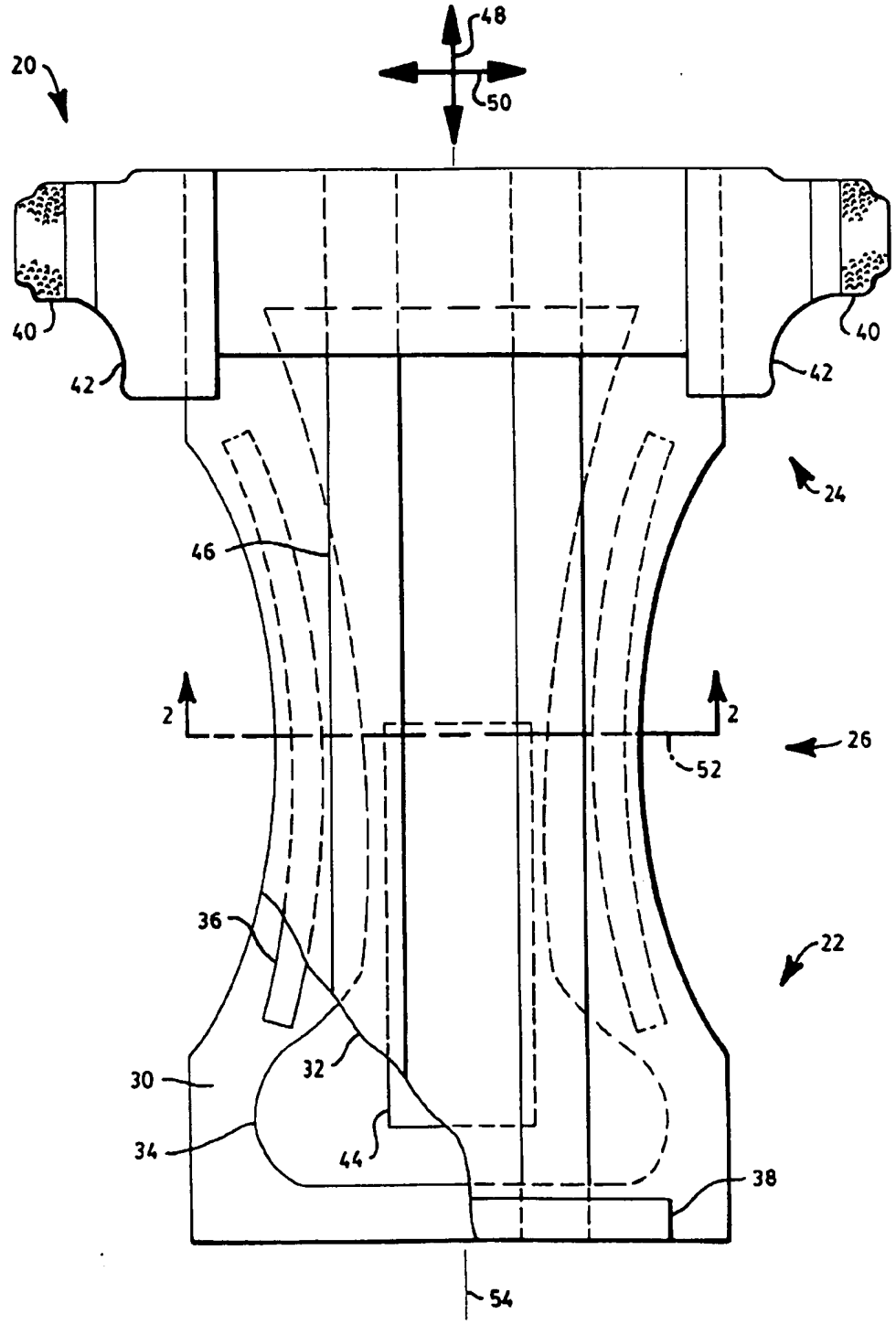

FIG.1

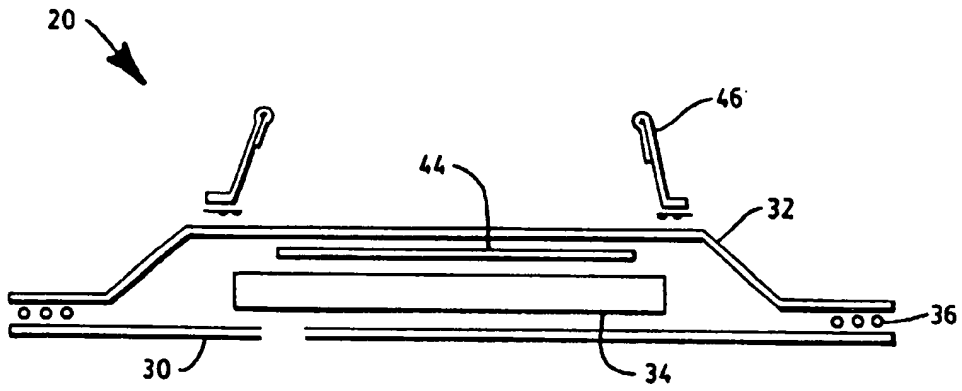

FIG. 2

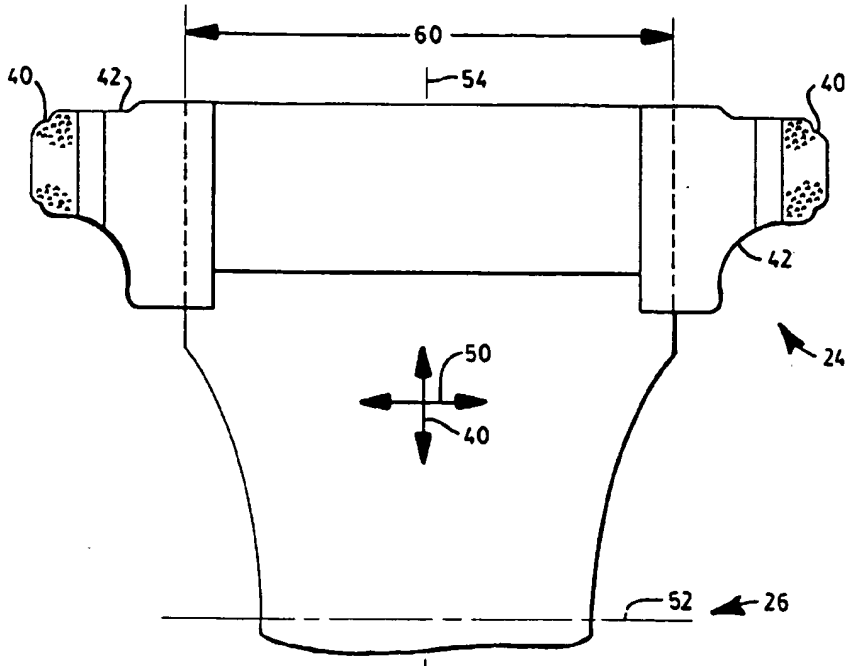

FIG.3

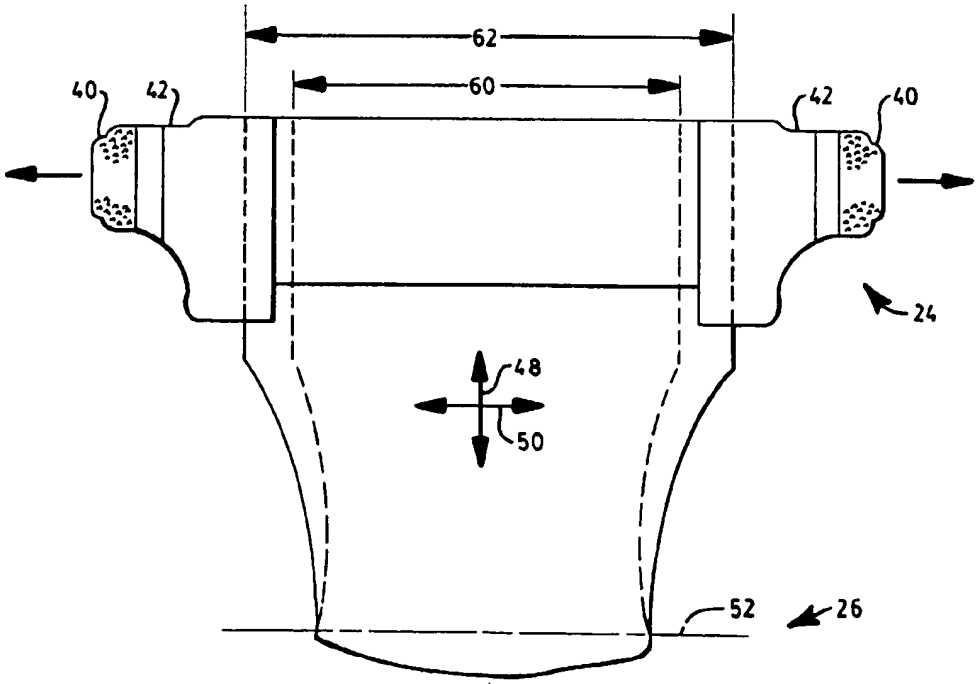

FIG.4

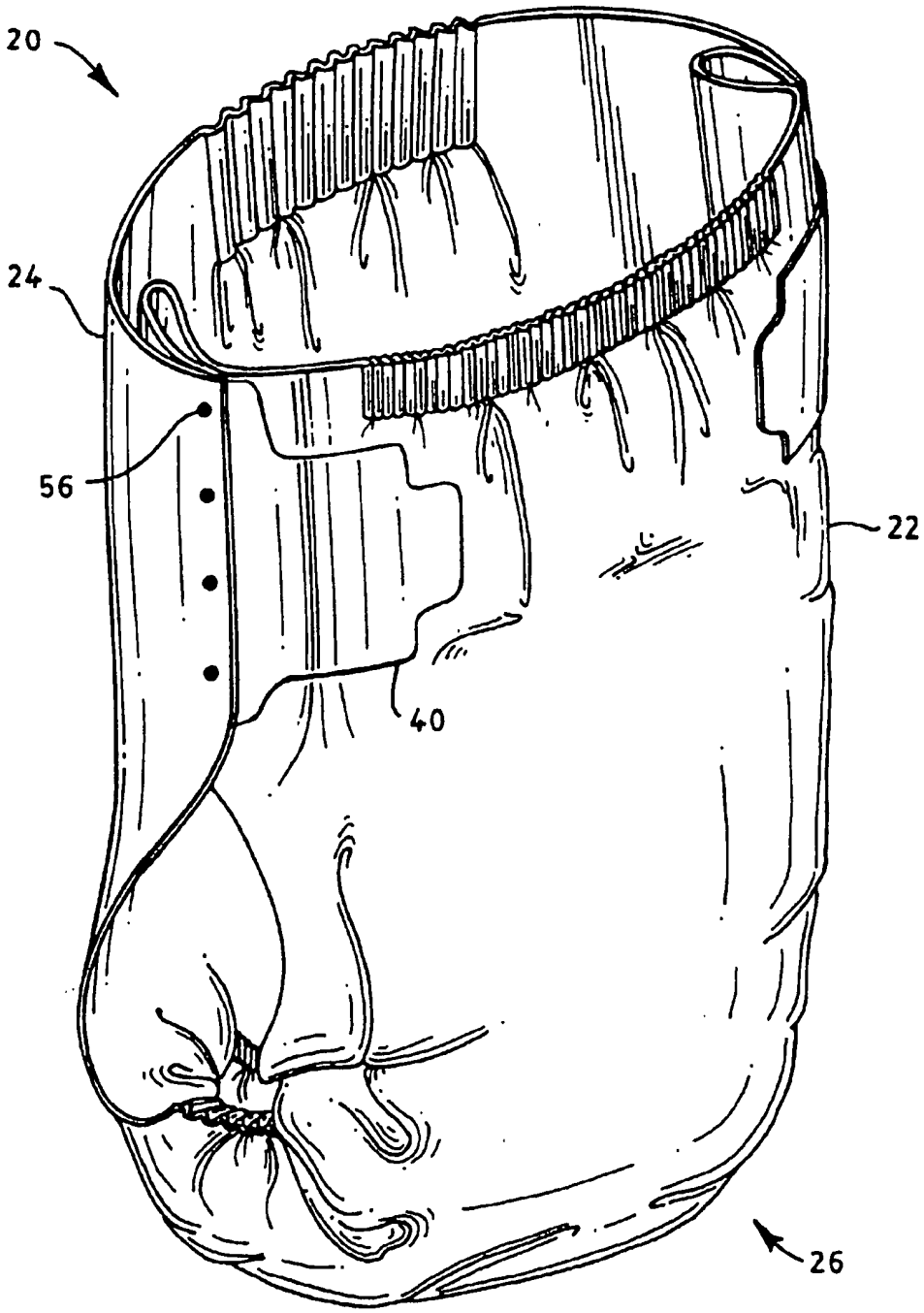

FIG. 5

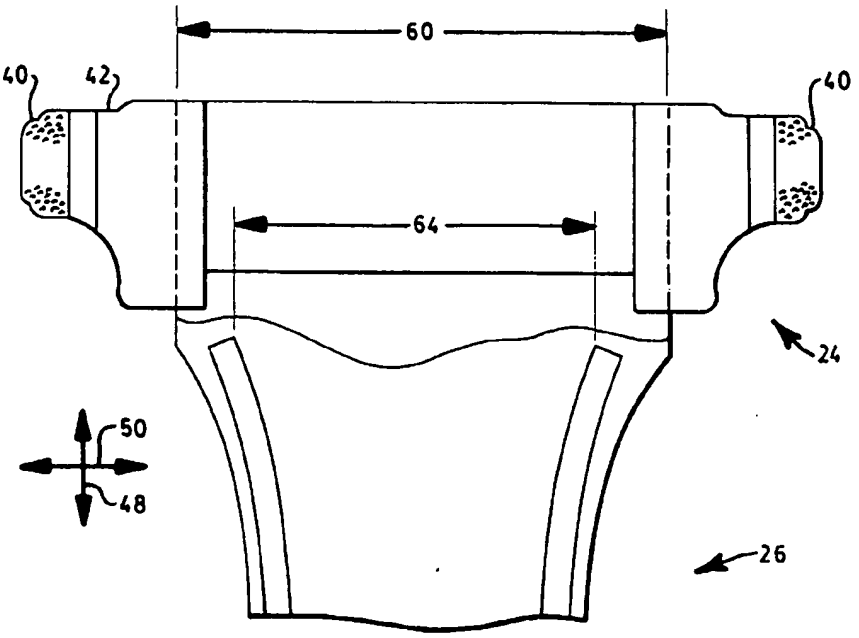

FIG. 6

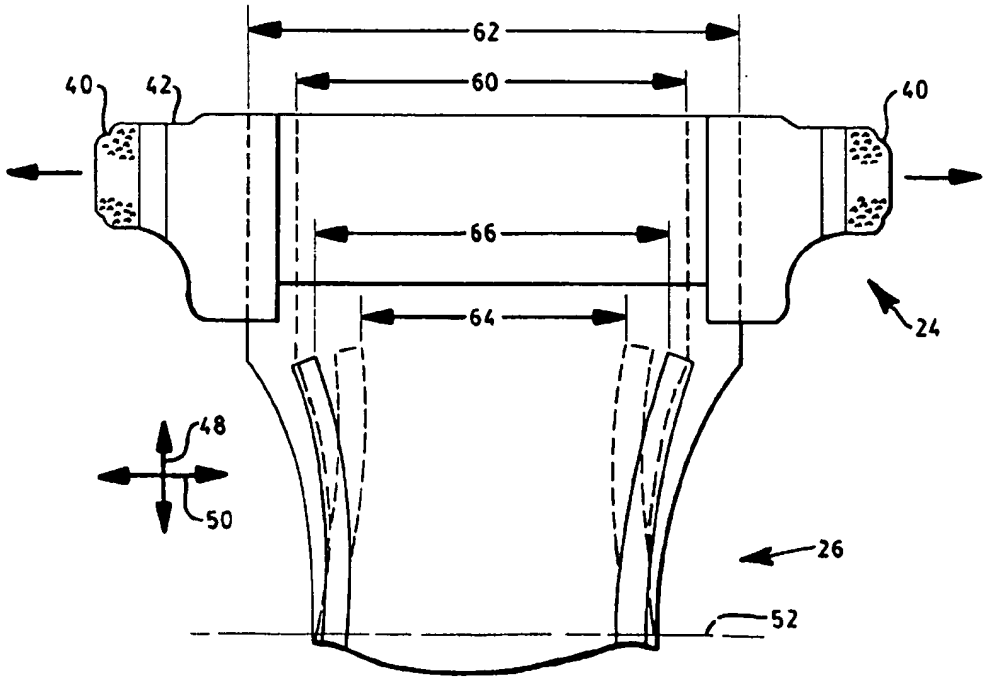

FIG. 7

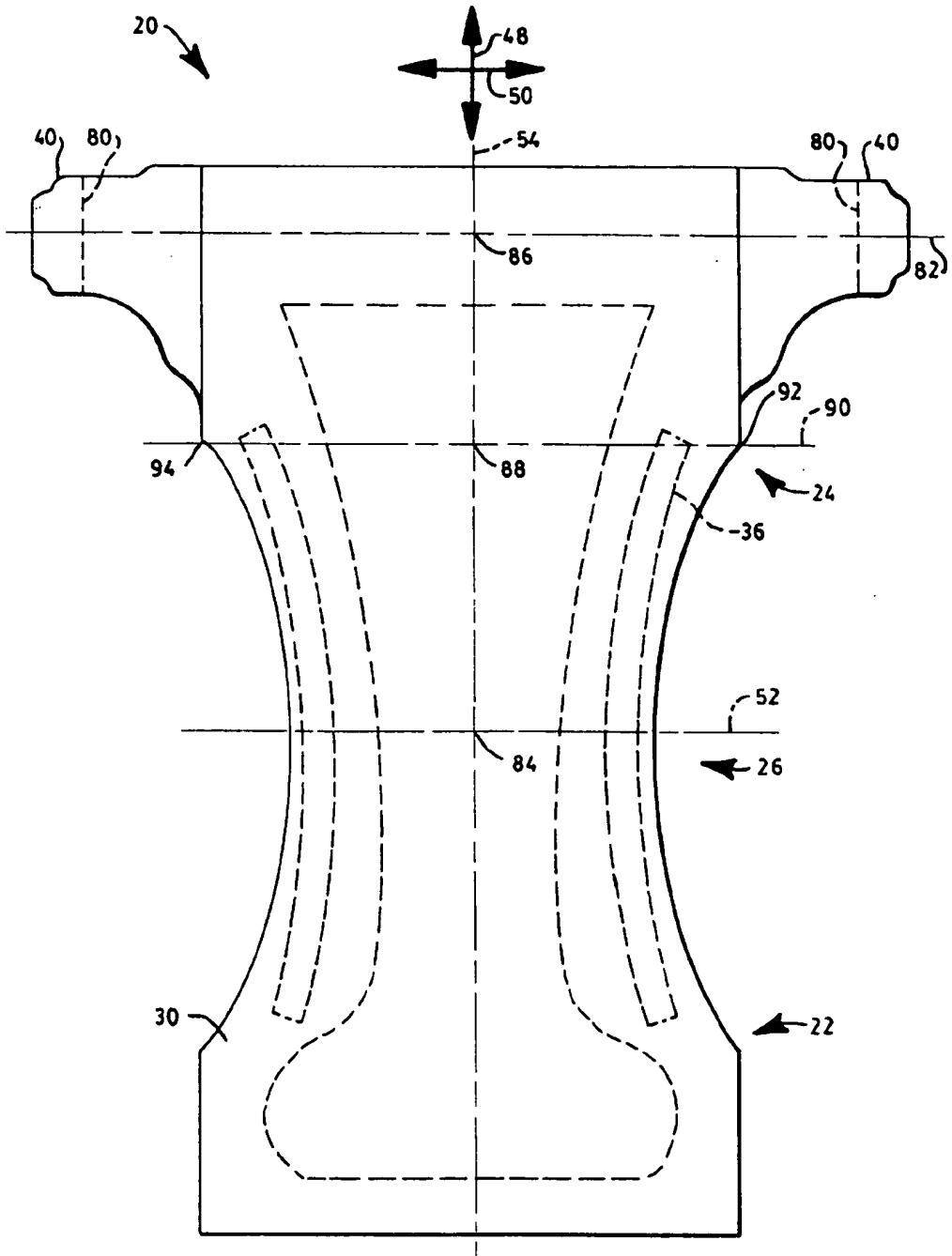

FIG.8

ABSORBENT ARTICLE HAVING AN EXTENSIBLE OUTER COVER AND AN EXTENSIBLE BODYSIDE LINER

FIELD OF THE INVENTION

The present invention relates to absorbent articles, desirably disposable absorbent articles, which have a distinctive extensible outer cover and bodyside liner that provide improved fit in use.

BACKGROUND OF THE INVENTION

It is desired that absorbent articles such as diapers, training pants or incontinence garments provide a close, comfortable fit about the wearer and contain body exudates while maintaining skin health. In certain circumstances, it is also desirable that such absorbent articles are capable of being pulled up or down over the hips of the wearer to allow the wearer or caregiver to easily pull the article on and easily remove the article if it has not been soiled. For example, such absorbent articles can assist in the toilet training of children.

Many conventional absorbent articles have typically employed fasteners that attach the waist sections of the articles around a wearer as well as various configurations of waist elastics, leg elastics, elasticized liners, and elasticized outer covers. The fasteners and elastic components have been employed to help produce and maintain the fit of the articles about the body contours of the wearer that can lead to improved containment. Maintaining this fit as the wearer moves and changes body position has been particularly difficult. For example, articles such as diapers are typically applied while the wearer is in a prone position wherein their torso is extended and their abdomen is sunken. As the wearer changes from the prone position to a sitting position, the wearer's torso compresses and their abdomen extends outwardly thereby exerting forces on the article. If the waistband of the article does not have enough "give", such forces can cause the waistband to shift that can undesirably result in increased leakage.

In an attempt to provide a maintained fit during movement, some conventional absorbent articles have included an outer cover composed of elastomeric materials, such as elastomeric, stretch-bonded-laminate materials. Such materials have included a layer of meltblown elastomeric fibers which has been stretched and sandwiched between facing layers composed of polypropylene spunbond nonwoven materials. The meltblown layer has typically been pattern-bonded to the facing layers with thermal bonds, sonic bonds and/or adhesive bonds. Other conventional absorbent articles have included folded pleats in the outer cover. The pleats are arranged to expand open as the article absorbs liquids.

In absorbent articles that are capable of being pulled up or down over the hips of the wearer, the ability of the article to provide and maintain the desired fit is particularly important. For example, some conventional absorbent articles, such as conventional training pants, have included integral side panels that connect the front waist section to the back waist section of the absorbent article. The side panels have been made stretchable such that the waist opening of the absorbent article can expand to allow the absorbent article to be pulled up or down over the hips of the wearer if desired. Such side panels have also been designed such that they may be torn to remove the training pant from the wearer after it has been soiled but typically are not refastenable.

Moreover, in an attempt to reduce the humidity level within such absorbent articles to help maintain the health of the wearer's skin, breathable polymer films have been employed as outer covers for such absorbent articles. The breathable films are typically constructed with micropores to provide desired levels of liquid impermeability and air permeability. Other absorbent article designs have been arranged to provide breathable regions in the form of breathable panels or perforated regions in otherwise vapor-impermeable outer covers to help ventilate the articles.

However, many of such attempts to provide absorbent articles that provide the desired fit while maintaining breathability have not been completely satisfactory. For example, some absorbent articles that include elastic outer cover materials have resulted in excessive skin irritation as it has been difficult to control the tension in such products. Moreover, such elastic outer covers typically have not exhibited the desired resistance to leakage as they have not readily expanded to provide void volume for the containment of fecal exudates. In addition, absorbent articles such as training pants have not always been able to achieve a close conforming fit to the wearer while still being able to expand enough to be pulled up and down over the hips of the wearer. Often such training pants fit the waist of the wearer loosely, which can undesirably result in leaks. As a result, many of such articles have not contained bodily exudates as effectively as conventional diaper-type articles which can be adjusted to achieve a more conforming fit to the wearer.

Further, articles which employ selectively located breathable panels can be difficult to manufacture. In addition, articles that employ microporous or perforated films that are highly breathable over their entire surface can exhibit excessive leakage of liquids or high levels of moisture or dampness on their outer surface in the region of the article receiving the greatest insults. As a result, the breathability of such microporous and perforated films has been maintained at relatively low levels to reduce the incidence of leakage and dampness on the outer cover. Thus, many of such absorbent articles have not been able to maintain a high level of breathability to sufficiently reduce the hydration of the wearer's skin. As a result, the wearer's skin has remained susceptible to rashes, abrasion and irritation.

Accordingly, despite the attempts to develop improved absorbent articles, there remains a need for absorbent articles that can provide improved fit, resistance to leakage and breathability without excessive irritation to the skin of the wearer. Moreover, in some circumstances, there remains a need that such absorbent articles provide the benefits of conventional training pants and conventional diapers. That is, there remains a need for absorbent articles that conform to the wearer to effectively contain bodily exudates, are breathable and are capable of being pulled up and down over the hips and buttocks of the wearer.

BRIEF DESCRIPTION OF THE INVENTION

In response to the difficulties and problems discussed above, new absorbent article designs have been discovered which provide improved breathability, fit and containment. Generally stated, the present invention provides a disposable absorbent article that defines a front waist section, a rear waist section, an intermediate section which extends between and connects the waist sections, a pair of laterally opposed side edges, a pair of longitudinally opposed waist edges, a longitudinal direction and a lateral direction. The absorbent article includes a substantially liquid-impermeable outer cover, a liquid-permeable bodyside liner

and an absorbent body located between the outer cover and the bodyside liner. The absorbent article may also include a pair of fasteners located on the laterally opposed side edges intone of the waist sections. In certain aspects, the disposable absorbent article may be provided in a prefastened, pant-like configuration such that the article can be pulled on or off over the hips of the wearer similar to conventional training pants. For example, the fasteners may refastenably attach the laterally opposed side edges in the front waist section to the laterally opposed side edges in the rear waist section to provide the pant-like, prefastened absorbent article prior to packaging the articles.

In particular aspects, the outer cover may be extensible and configured to provide a substantially permanent deformation of at least about 10 percent, desirably at least about 15 percent, particularly at least about 17 percent, more desirably at least about 20 percent, even more desirably at least about 25 percent, and yet even more desirably at least about 30 percent when subjected to a tensile force of 100 gmf per inch of width according to the Material Elongation and Deformation Tensile Test set forth herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and further advantages will become apparent when reference is made to the following detailed description of the invention and the drawings, in which:

FIG. **1** representatively shows a partially cut-away, top plan view of the inward surface of an example of an article of the invention;

FIG. **2** representatively shows an expanded, lateral cross-sectional view taken with respect to line **2—2** of FIG. **1**;

FIG. **3** representatively shows a partial top plan view of the inward surface of the article of FIG. **1** in a relaxed, non-extended configuration;

FIG. **4** representatively shows a partial top plan view of the inward surface of the article of FIG. 1 in a relaxed configuration after the fasteners in such article have been subjected to an extension force in the lateral direction thereby permanently extending the outer cover in the waist section of the article;

FIG. **5** representatively shows a perspective view of an example of an article of the invention in a prefastened, pant-like configuration;

FIG. **6** representatively shows a partial top plan view of the inward surface of the article of FIG. **1** in a relaxed, non-extended configuration;

FIG. **7** representatively shows a partial top plan view of the inward surface of the article of FIG. 1 in a relaxed configuration after the fasteners in such article have been subjected to an extension force in the lateral direction thereby permanently extending the outer cover and leg elastics in the waist section of the article; and

FIG. **8** representatively shows the article of FIG. 1 as prepared for the Product Deformation Test set forth herein.

DETAILED DESCRIPTION OF THE INVENTION

The various aspects and embodiments of the invention will be described in the context of disposable absorbent articles, such as a disposable diaper or training pant. It is, however, readily apparent that the present invention could also be employed with other absorbent articles, such as feminine care articles, incontinence garments and the like. Typically, the disposable articles are intended for limited use and are not intended to be laundered or otherwise cleaned for reuse. A disposable diaper, for example, is discarded after it has become soiled by the wearer.

By incorporating its various aspects, the articles of the present invention can provide improved fit and improved resistance to leakage. In particular, the extensible outer cover of the articles is capable of adjusting to the wearer's movements and the wearer's body position and dimensions for improved performance. In addition, the articles of the invention can provide improved breathability, greater softness, greater coverage over the hips and buttocks of the wearer and more cloth-like properties. Moreover, in certain aspects, the present invention can advantageously provide pant-like, prefastened, absorbent articles that are capable of being reliably pulled up or down over the hips of the wearer to assist in the toilet training of the wearer similar to conventional training pants.

When employed in the present disclosure, the terms "comprises", "comprising" and other derivatives from the root term "comprise" are intended to be open-ended terms that specify the presence of any stated features, elements, integers, steps, or components, but do not preclude the presence or addition of one or more other features, elements, integers, steps, components, or groups thereof. Accordingly, such terms are intended to be synonymous with the words "has", "have", "having", "includes", "including" and any derivatives of these words.

As used herein, the term "extensible material" refers to a material that can a provide a substantially permanent deformation of at least about 10 percent, desirably at least about 15 percent, particularly at least about 17 percent, more desirably at least about 20 percent, even more desirably at least about 25 percent, and yet even more desirably at least about 30 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to the Material Elongation and Deformation Tensile Test set forth herein. In general, the Material Elongation and Deformation Tensile Test is conducted similar to ASTM Standard Test Method D882 (Tensile Method for Tensile Properties of Thin Plastic Sheeting) dated December 1995. The initial separation of the jaws of the tensile tester is 3 inches (76.2 mm) at a tensile force of about 1 gram force per inch of width of the test sample, and the moving jaw is moved at a constant rate of 127 mm/min. The moving jaw is stopped at an extension where the tensile force equals 1.00 grams force per inch of width of the test sample, held at that extension for a period of 2 minutes, and then returned back to its initial tensile force of about 1 gram force per inch of width of the test sample at a rate of 127 mm/min.

FIG. **1** is a representative plan view of an absorbent article, such as disposable diaper **20**, of the present invention in its flat-out, uncontracted state (i.e., with all elastic induced gathering and contraction removed). Portions of the structure are partially cut away to more clearly show the interior construction of diaper **20**, and the surface of the diaper which contacts the wearer is facing the viewer. FIG. **2** representatively shows a sectional view of the absorbent article of FIG. 1 taken along line **2—2**. With reference to FIGS. **1** and **2**, the disposable diaper **20** generally defines a front waist section **22**, a rear waist section **24**, and an intermediate section **26** which interconnects the front and rear waist sections. The front and rear waist sections **22** and **24** include the general portions of the article which are constructed to extend substantially over the wearer's front and rear abdominal regions, respectively, during use. The intermediate section **26** of the article includes the general portion of the article that is constructed to extend through the

wearer's crotch region between the legs. Thus, the intermediate section **26** is an area where repeated liquid surges typically occur in the diaper or other disposable absorbent article.

The absorbent article includes an outer cover **30**, a liquid permeable bodyside liner **32** positioned in facing relation with the outer cover **30**, and an absorbent body **34**, such as an absorbent pad, which is located between the outer cover **30** and the bodyside liner **32**. The outer cover **30** defines a length and a width which, in the illustrated embodiment, coincide with the length and width of the diaper **20**. The absorbent body **34** generally defines a length and width that are less than the length and width of the outer cover **30**, respectively. Thus, marginal portions of the diaper **20**, such as marginal sections of the outer cover **30**, may extend past the terminal edges of the absorbent body **34**. In the illustrated embodiments, for example, the outer cover **30** extends outwardly beyond the terminal marginal edges of the absorbent body **34** to form side margins and end margins of the diaper **20**. The bodyside liner **32** is generally coextensive with the outer cover **30** but may optionally cover an area which is larger or smaller than the area of the outer cover **30**, as desired. The outer cover **30** and bodyside liner **32** are intended to face the garment and body of the wearer, respectively, while in use.

To provide improved fit and to help reduce leakage of body exudates from the diaper **20**, the diaper side margins and end margins may be elasticized with suitable elastic members, such as single or multiple strands of elastic. For example, as representatively illustrated in FIGS. **1** and **2**, the diaper **20** may include leg elastics **36** which are constructed to operably gather and shirr the side margins of the diaper **20** to provide elasticized leg bands which can closely fit around the legs of the wearer to reduce leakage and provide improved comfort and appearance. Similarly, waist elastics, **38** can be employed to elasticize the end margins of the diaper **20** to provide elasticized waistbands.

The waist elastics are configured to operably gather and shirr the end margins to provide a resilient, comfortably close fit around the waist of the wearer. In the illustrated embodiments, the elastic members are illustrated in their uncontracted, stretched condition for the purpose of clarity.

Materials suitable for use as the leg elastics **36** and waist elastics **38** are well known to those skilled in the art. Exemplary of such materials are sheets or strands or ribbons of a polymeric, elastomeric material which are adhered to the outer cover **30** in a stretched position, or which are attached to the outer cover **30** while the outer cover is pleated, such that elastic constrictive forces are imparted to the outer cover **30**. The leg elastics may also include such materials as polyurethane, synthetic and natural rubber that may optionally be heat shrinkable or heat elasticizable.

Fastening means, such as hook and loop fasteners **40**, may be employed to secure the diaper on a wearer. Alteratively, other fastening means, such as buttons, pins, snaps, adhesive tape fasteners, cohesives, mushroom-and-loop fasteners, or the like, may be employed. In the illustrated embodiment, the diaper **20** further includes a pair of side panels **42** to which the fasteners **40** are attached. Generally, the side panels **42** are attached to the side edges of the diaper **20** in one of the waist sections and extend laterally outward therefrom. The side panels **42** may be elasticized or otherwise rendered elastomeric.

For example, the side panels **42** may be an elastomeric material such as a neck-bonded laminate (NBL) or stretch-bonded laminate (SBL) material. Methods of making such materials are well known to those skilled in the art and are described in U.S. Pat. No. 4,663,220 issued May 5, 1987 to Wisneski et al., U.S. Pat. No. 5,226,992 issued Jul. 13, 1993 to Morman, and European Patent Application No. EP 0 217 032 published on Apr. 8, 1987 in the names of Taylor et al., the disclosures of which are hereby incorporated by reference. Examples of articles that include elasticized side panels and selectively configured fastener tabs are described in PCT Patent Application No. WO 95/16425 published Jun. 22, 1995 to Roessler; U.S. Pat. No. 5,399,219 issued Mar. 21, 1995 to Roessler et al.; U.S. Pat. No. 5,540,796 to Fries; and U.S. Pat. No. 5,595,618 to Fries; the disclosures of which are also incorporated herein by reference.

The diaper **20** may also include a surge management layer **44** located between the bodyside liner **32** and the absorbent body **34** to prevent pooling of the fluid exudates and further improve the distribution of the fluid exudates within the diaper **20**. The diaper **20** may further include a ventilation layer (not illustrated) located between the absorbent body **34** and the outer cover **30** to insulate the outer cover **30** from the absorbent body **34** to reduce the dampness of the garment facing surface of the outer cover **30**. Examples of suitable surge management layers **44** are described in U.S. Pat. No. 5,486,166 to Bishop and U.S. Pat. No. 5,490,846 to Ellis, the entire disclosures of which are hereby incorporated by reference.

As representatively illustrated in FIGS. **1** and **2**, the disposable diaper **20** may also include a pair of containment flaps **46** which are configured to provide a barrier to the lateral flow of body exudates. The containment flaps **46** may be located along the laterally opposed side edges of the diaper **20** adjacent the side edges of the absorbent body **34**. Each containment flap **46** typically defines an unattached edge which is configured to maintain an upright, perpendicular configuration in at least the intermediate section **26** of the diaper **20** to form a seal against the wearer's body. The containment flaps **46** may extend longitudinally along the entire length of the absorbent body **34** or may only extend partially along the length of the absorbent body **34**. When the containment flaps **46** are shorter in length than the absorbent body **34**, the containment flaps **46** can be selectively positioned anywhere along the side edges of the diaper **20** in the intermediate section **26**. In a particular aspect of the invention, the containment flaps **46** extend along the entire length of the absorbent body **34** to better contain the body exudates.

Such containment flaps **46** are generally well known to those skilled in the art. For example, suitable constructions and arrangements for containment flaps **46** are described in U.S. Pat. No. 4,704,96 issued Nov. 3, 1987, to K. Enloe, the disclosure of which is hereby incorporated by reference.

The diaper **20** may be of various suitable shapes. For example, the diaper may have an overall rectangular shape, T-shape or an approximately hour-glass shape. In the shown embodiment, the diaper **20** has a generally I-shape. The diaper **20** further defines a longitudinal direction **48**, a lateral direction **50**, a longitudinal centerline **54** and a lateral centerline **52**. Other suitable components which may be incorporated on absorbent articles of the present invention include waist flaps and the like which are generally known to those skilled in the art.

Examples of diaper configurations suitable for use in connection with the instant invention which may include other components suitable for use on diapers are described in U.S. Pat. No. 4,798,603 issued Jan. 17, 1989, to Meyer et al.; U.S. Pat. No. 5,176,668 issued Jan. 5, 1993, to Bernar-

din; U.S. Pat. No. 5,176,672 issued Jan. 5, 1993, to Bruemmer et al.; U.S. Pat. No. 5,192,606 issued Mar. 9, 1993, to Proxmire et al., and U.S. Pat. No. 5,509,915 issued Apr. 23, 1996 to Hanson et al., the disclosures of which are herein incorporated by reference.

The various components of the diaper **20** are integrally assembled together employing various types of suitable attachment means, such as adhesive, sonic bonds, thermal bonds or combinations thereof. In the shown embodiment, for example, the bodyside liner **32** and outer cover **30** may be assembled to each other and to the absorbent body **34** with lines of adhesive, such as a hot melt, pressure-sensitive adhesive. Similarly, other diaper components, such as the elastic members **36** and **38**, fastening members **40**, and surge layer **44** may be assembled into the article by employing the above-identified attachment mechanisms.

The article of the invention includes a distinctive extensible outer cover **30** which includes an extensible fabric layer which is operatively attached or otherwise joined to extend over a major portion of the outward surface of the article. In regions where the extensible outer cover **30** is not affixed to non-extensible portions of the article or otherwise restricted from extending, the extensible outer cover **30** can be free to advantageously expand with minimal force and with a high amount of permanent deformation. In desired aspects, the outer cover **30** can be extensible along the longitudinal direction **48**, lateral direction **50**, or along a combination of both the lateral and longitudinal directions.

In particular, it is desirable that the portion of the extensible outer cover **30** located in the waist sections **22** and **24** is capable of extending and permanently deforming in the lateral direction **50** to provide improved fastening of the article about the wearer, improved coverage of the hips and buttocks of the wearer particularly in the rear waist section and enhanced breathability in the waist sections. For example, if the fasteners **40** and or side panels **42** are located along the side edges in the rear waist section **24** of the diaper **20**, at least a portion of the outer cover **30** in the rear waist section **24** will desirably extend to provide enhanced coverage over the buttocks of the wearer in use for improved containment and aesthetics. The enhanced buttock coverage is due to the permanent deformation of the outer cover **30** in the rear waist section **24** when lateral forces are exerted to fasten the diaper **20** about the wearer.

Moreover, it is also desirable that at least portions of the extensible outer cover **30** located over the absorbent body **34** can extend during use for improved containment. For example, as the absorbent body **34** absorbs fluid exudates and expands outwardly, the extensible outer cover **30** can readily elongate and extend in correspondence with the expansion of the absorbent body **34** and/or other components of the article to provide void volume to more effectively contain the exudates.

The extensible outer cover **30** may also be selectively elasticized in certain regions by attaching elastomeric components to the extensible outer cover **30** in such regions. For example, the extensible outer cover **30** may be elasticized adjacent the leg openings by attaching the leg elastics **36** to the extensible outer cover **30**. Moreover, if desired, substantially non-extensible regions can be created in the extensible outer cover **30** by attaching such regions to a substantially non-extensible component. For example, as described below, the diaper **20** may include an attachment panel attached to the extensible outer cover **30** in the front waist section **22** of the diaper **20**. If the attachment panel is made of a non-extensible material it will limit the extensibility of the outer cover **30** in the region it is attached. Generally, it is desirable that the majority of the extensible outer cover **30** remains extensible in use for improved performance.

The extensible outer cover **30** of the present invention is desirably capable of providing a selected elongation when subjected to an applied tensile force. The extensible outer cover **30** is also desirably capable of providing a selected, sustained deformation when subjected to an applied tensile force and then allowed to relax for a selected time period after removing the applied tensile force. The measurement of the selected time period begins immediately after the removal of the tensile force. Desirably, the sustained deformation is a substantially permanent deformation. The selected elongation and sustained deformation can occur at least along the lateral direction **50** of the article.

Optionally, the selected elongation and sustained deformation can occur along the longitudinal direction **48** of the article, or may occur along both the lateral direction and longitudinal direction of the article.

In particular aspects, the extensible outer cover **30** can provide an elongation of at least about 10 percent, desirably at least about 20 percent, more desirably at least about 30 percent and even more desirably at least about 40 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein. Elongation less than those above may not provide the desired expansion for the improved fastening, containment, enhanced buttock coverage and breathability discussed herein. In other aspects, the extensible outer cover **30** can be capable of providing an elongation of from about 10 percent to about 200 percent and desirably from about 30 percent to about 100 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein.

In certain aspects, the extensible outer cover **30** can also provide a substantially permanent deformation of at least about 10 percent, desirably at least 15 percent, particularly at least about 17 percent, more desirably at least about 20 percent, even more desirably at least about 25 percent and yet even more desirably at least about 30 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein. Substantially permanent deformations less than those set forth above may not provide the desired improved fastening, containment, enhanced buttock coverage and breathability. In still other aspects, the extensible outer cover **30** can provide a substantially permanent deformation of from about 10 to about 200 percent and desirably from about 17 to about 100 percent when subjected to the tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein.

In particular aspects, the extensible outer cover **30** can provide a combination of elongation and substantially permanent deformation as set forth above for improved performance.

It should be noted that the elongation, extension or permanent deformation properties of the extensible outer cover **30** are determined When the outer cover **30** is dry. Additionally, the percentage of elongation, extension or permanent deformation can be determined in accordance with the following formula:

$100*(L-L_o)/(L_o)$;

where:

L=either a) extended length for elongation or extension or b) post extended length for set or deformation, and

L_o=initial length.

The extension and permanent set or deformation of the extensible outer cover **30** of the different aspects of the present invention is particularly important when the article is provided in a pant-like configuration such as a conventional training pant or prefastened diaper that can be pulled up or down over the hips of the wearer in use. For example, as representatively illustrated in FIG. **5**, the diaper **20** may be provided in a prefastened pant-like configuration prior to packaging by releasably engaging the fasteners **40** with the opposite waist section during the manufacturing process. In such a configuration, the diaper **20** and, in particular, the waist sections **22** and **24** of the diaper **20** must be capable of extending such that the diaper **20** can be pulled on over the hips of the wearer. The use of the extensible outer cover **30** as described herein can provide the necessary levels of extensibility to allow the diaper **20** to function in a prefastened configuration.

For example, in embodiments wherein the article is provided in a prefastened, pant-like configuration, the extensible outer cover **30** desirably provides an elongation of at least about 20 percent, more desirably at least about 30 percent and a substantially permanent deformation of at least about 17 percent, more desirably at least about 20 percent when subjected to the tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein.

As illustrated in FIG. **5**, the pant-like diaper **20** may include passive bonds **56** between the respective waist sections to assist the fasteners **40** in maintaining the diaper **20** in the prefastened configuration. Absorbent articles including such passive bonds and methods of making them are further described in U.S. patent application entitled "DISPOSABLE ABSORBENT ARTICLES HAVING PASSIVE SIDE BONDS AND ADJUSTABLE FASTENING SYSTEMS" filed in the name of Elsberg on Jun. 19, 1998 and assigned U.S. Ser. No. 09/100,574, and U.S. patent application entitled "METHOD OF MAKING AN ABSORBENT ARTICLE WITH PREFASTENED SIDE PANELS AND ABSORBENT ARTICLES MADE BY THE SAME" filed in the name of McNichols on Jun. 19, 1998 and assigned U.S. Ser. No. 09/100,825, the disclosures of which are hereby incorporated by reference.

The extensible outer cover **30** of the different aspects of the present invention or at least a portion thereof is desirably substantially vapor permeable or breathable to allow the transmission of vapors out of the article to effectively reduce the humidity level within the diaper **20**. The vapor permeability of the extensible outer cover **30** is configured to enhance the breathability of the absorbent article to reduce the hydration of the wearer's skin during use without allowing excessive condensation of vapor, such as water, on the garment facing surface of the outer cover **30** which can undesirably dampen the wearer's clothes.

Desirably, the extensible outer cover **30** is constructed to be permeable to at least water vapor. For example, in particular embodiments, the extensible outer cover **30** defines a water vapor transmission rate (WVTR) according to the Mocon Water Vapor Transmission Rate Test set forth herein of at least about 800 g/sq.m/24 hr., desirably at least about 1200 g/sq.m/24 hr, more desirably at least about 2000 g/sq.m/24 hr., and even more desirably at least about 3000 g/sq.m/24 hr. in the non-extended condition. In such embodiments, the extensible outer cover **30** may define a WVTR of from about 800 to about 60,000 g/sq.m/24 hr. Materials which have a WVTR less than those above may not allow a sufficient amount of water vapor diffusion out of the diaper and undesirably result in increased levels of skin hydration.

During use, at least portions of the extensible outer cover **30** may be extended and permanently deformed such that these portions exhibit increased levels of breathability. For example, as representatively illustrated in FIGS. **3** and **4**, when the fasteners **40** are extended in the lateral direction **50** when fastening the diaper **20** about the wearer or pulling the diaper on over the hips of the wearer, the forces exerted on the extensible outer cover **30** cause the outer cover **30** to extend and permanently deform at least in portions of the outer cover between the fasteners **40**. The permanent deformation or set of the outer cover **30** in the regions between the fasteners increases the level of breathability of the outer cover **30** in such regions. For example, if the fasteners **40** and or side panels **42** are located along the side edges in the rear waist section **24** of the diaper **20**, at least a portion of the outer cover **30** in the rear waist section **24** will desirably exhibit an increased level of breathability in use. The enhanced breathability is due to the permanent deformation of the outer cover **30** when lateral forces are exerted to fasten the diaper **20** about the wearer. Thus, in use, the article of the different aspects of the present invention can provide regions or zones that exhibit increased levels of breathability in use.

A suitable method of predicting such levels of increased breathability during use is to measure the breathability of a sample of the outer cover **30** before it is extended and held at an extension of 25 percent. Desirably, the sample of the extensible outer cover **30** of the article of the present invention provides a breathability increase while extended 25 percent of at least about 10 percent, more desirably at least about 25 percent, even more desirably at least about 50 percent, yet even more desirably at least about 100 percent. Breathability increases less than those set forth above may not provide the desired level of enhanced breathability. The breathability of the samples is determined using the Mocon Water Vapor Transmission Rate set forth herein. To ensure the sample is held in the 25% extended condition during the Mocon test, adhesive such as double sided tape commercially available from 3M may be applied to one face of the Mocon sample holder such that the adhesive prevents the sample from retracting.

In a particular embodiment, the extensible outer cover **30** defines a water vapor transmission rate of at least about 800 g/sq.m/24 hr., desirably at least about 1200 g/sq.m/24 hr, more desirably at least about 2000 g/sq.m/24 hr., and even more desirably at least about 3000 g/sq.m/24 hr. in the non-extended condition and a breathability increase as set forth above while it is held at an extension of 25 percent in the lateral direction **50** for improved performance.

Typically, the forces exerted on the outer cover **20** when fastening the diaper **20** about the wearer's waist are localized in at least one of the front and rear waist sections **22** and **24** of the diaper **20**. As a result, the extension of the fasteners **40** upon the initial fastening about the wearer tends to cause the outer cover **30** in at least one of the front and rear waist sections **22** and **24** to extend and permanently deform. Such permanent deformation of the outer cover **30** results in increased breathability in at least one of the waist sections **22** and **24** of the diaper **20**.

This increase in breathability of the outer cover **30** in at least one of the waist sections **22** and **24** desirably occurs without a substantial increase in the breathability of the outer cover **30** in the intermediate section **26** of the diaper **20** upon the fastening of the diaper **20** about the wearer. For example, as illustrated in FIGS. **3** and **4**, the extensible outer cover **30** may define a non-extended distance **60** between the fasteners **40** prior to use and an extended distance **62** after the fasteners **40** are extended in use to fasten the article about the waist of the wearer. As can be seen in FIG. **4**, the extension of the fasteners **40** in the lateral direction **50** extends the outer cover **30** in the rear waist section **24** between the fasteners **40** but does not result in any substantial extension of the outer cover **30** along the lateral centerline **52** of the diaper **20**. Thus, in use, the diaper **20** can provide a longitudinal breathability gradient between the waist sections **22** and **24** and the intermediate section **26** of the diaper **20**. Such a longitudinal breathability gradient can provide improved water vapor or humidity reduction within the diaper **20** without excessive outer cover dampness and/or leakage since the portion of the diaper intended to receive the majority of the fluid insults, that is the intermediate section **26** of the diaper **20**, can exhibit a lower level of breathability than the waist sections **22** and **24** of the diaper **20**.

As a result, the extensible outer cover **30** desirably may provide zones of higher breathability in the waist sections **22** or **24** of the diaper **20** in use when compared to the level of breathability of the outer cover **30** in the intermediate section **26** of the diaper **20**. The portion of the absorbent **34** located in the waist sections and, in particular, the rear waist section typically stays drier than other portions of the absorbent in use. Thus, in use, the drier absorbent in at least the rear waist section allows a channel for the water vapor adjacent the skin to leave the diaper through the zones of higher breathability in the waist sections thereby leading, directly to reduced skin hydration. Whereas, if the portion of the outer cover **30** in the intermediate section **26** had such high levels of breathability, undesirable dampness and condensation on the outer cover **30** might occur as this is the region most likely to be saturated in use. Moreover, a high level of breathability of the outer cover **30** in the intermediate section **26** may allow the garment facing side of the absorbent to partially dry out but typically would not significantly reduce skin hydration after the absorbent is saturated. As a result, the zones of higher breathability in the waist sections provided by the extensible outer cover **30** of the diaper of the present invention can provide reduced skin hydration and improved skin health.

The extensible outer cover **30** of the different aspects of the present invention may also provide a lateral breathability gradient such that the side edges of the diaper have a greater level of breathability than the center of the diaper. For example, if the outer cover **30** is attached to other components of the diaper **20** such as the absorbent **34**, the extension of the fasteners **40** in the lateral direction **50** extends the unattached portions of the outer cover **30** such as those laterally outward of the absorbent **34** a greater amount than the attached portions. Thus, the breathability of the unattached portions may be increased without resulting in a substantial increase in the breathability of the outer cover **30** overlying and attached to the absorbent **34**. Thus, in use, the diaper **20** can also provide a lateral breathability gradient between center and side edges of the diaper. Such a lateral breathability gradient can provide reduced water vapor or humidity within the diaper **20** without excessive outer cover dampness and/or leakage since the portion of the outer cover **30** over the absorbent **34** can exhibit a lower level of breathability than the side margins of the diaper **20**.

A suitable method of predicting such lateral and longitudinal breathability gradients during use is the Product Deformation Test described herein. In general, to determine the longitudinal breathability gradient, the breathability of the outer cover **30** located along the longitudinal centerline of the diaper between the fasteners **40** is determined and compared to the breathability of the outer cover **30** in the intermediate section **26** of the diaper **20** after the fasteners **40** on the diaper **20** are subjected to four cycles of a tensile force of 2000 gmf in the lateral direction **50**, held at that extension for a period of 1 minute, and then allowed to relax, after a removal of the cyclic tensile force, for a period of at least 24 hours.

Desirably, the extensible outer cover **30** of the article of the present invention provides a longitudinal breathability gradient ratio between the regions of the outer cover **30** in the waist section **22** or **24** and the intermediate section **26** of the article of at least about 1.25, more desirably at least about 1.50, even more desirably at least about 1.75, and yet even more desirably at least about 2.00 when subjected to the Product Deformation Test. For example, the extensible outer cover **30** of the article of the present invention can provide a longitudinal breathability gradient ratio of from about 1.25 to about 30.00 for improved performance. Longitudinal breathability gradient ratios less than those set forth above may not provide the desired level of enhanced breathability or may result in excessive moisture on the outer cover in the intermediate section of the diaper in use.

In a particular embodiment, the extensible outer cover **30** defines a water vapor transmission rate of at least about 800 g/sq.m/24 hr., desirably at least about 1200 g/sq.m/24 hr, more desirably at least about 2000 g/sq.m/24 hr., and even more desirably at least about 3000 g/sq.m/24 hr. in the non-extended condition and a longitudinal breathability gradient ratio between the regions of the outer cover **30** in the waist section **22** or **24** and the intermediate section **26** of the article as set forth above when subjected to the Product Deformation Test for improved performance.

In general, to determine the lateral breathability gradient, a portion of the outer cover **30** centered about the intersection of the longitudinal centerline **54** of the article and a lateral line between the center of the fasteners **40** is removed and a portion of the outer cover **30** adjacent the fasteners along the laterally opposed side edges of the article and centered about the lateral line between the center of the fasteners **40** is also removed after the fasteners **40** on the diaper **20** are subjected to four cycles of a tensile force of 2000 gmf in the lateral direction **50**, held at that extension for a period of 1 minute each and then allowed to relax, after a removal of the cyclic tensile force, for a period of at least about 24 hours.

Both portions are subjected to the Mocon Water Vapor Transmission Test set forth herein and the results are recorded. The lateral breathability gradient ratio of the outer cover **30** is then determined by dividing the breathability of the portion of the outer cover **30** taken adjacent the fasteners **40** by the portion of the outer cover taken from along the longitudinal centerline **54** of the article between the fasteners **40**.

Desirably, the extensible outer cover **30** of the article of the present invention provides a lateral breathability gradient ratio between the regions of the outer cover **30** in the waist section **22** or **24** and the intermediate section **26** of the article of at least about 1.25, more desirably at least about 1.50, even more desirably at least about 1.75, and yet even more

desirably at least about 2.00 when subjected to the Product Deformation Test. For example, the extensible outer cover **30** of the article of the present invention can provide a lateral breathability gradient ratio of from about 1.25 to about 10.00 for improved performance. Lateral breathability gradient ratios less than those set forth above may not provide the desired level of enhanced breathability or may result in excessive moisture on the outer cover located over the absorbent of the diaper in use.

In a particular embodiment, the extensible outer cover **30** defines a water vapor transmission rate of at least about 800 g/sq.m/24 hr., desirably at least about 1200 g/sq.m/24 hr, more desirably at least about 2000 g/sq.m/24 hr., and even more desirably at least about 3000 g/sq.m/24 hr. in the non-extended condition and provides a lateral breathability gradient ratio as set forth above when subjected to the Product Deformation Test for improved performance.

In the various configurations of the invention, the extensible outer cover **30** is also configured to be substantially impermeable to aqueous liquid. For example, the outer cover **30** can have a construction that is capable of supporting a selected hydrohead of water substantially without leakage therethrough. A suitable technique for determining the resistance of a material to liquid penetration is Federal Test Method Standard FTMS 191 Method 5514, 1978, or an equivalent thereof. Since the outer cover **30** is extensible, a layer of nylon net material having a thickness of about 0.1 mm may be needed to support the outer cover material for this test. The net material may be provided by nylon threads arranged in a hexagonal or honeycomb-like pattern with openings approximately 4 mm across. For example, the net material may be purchased from Wal-Mart Stores under the trade designation T-246. The net material is liquid pervious and does not significantly affect the hydrohead values obtained. The extensible outer cover **30** is sufficiently impermeable to liquid and semi-liquid materials to substantially prevent the undesired leakage of waste materials, such as urine and feces. For example, the extensible outer cover **30** can desirably support a hydrohead of at least about 45 centimeters (cm) substantially without leakage. The extensible outer cover **30** can alternatively support a hydrohead of at least about 55 cm, and optionally, can support a hydrohead of at least about 60 cm, or more, to provide improved benefits.

The extensible outer cover **30** can be composed of various materials that can provide the desired properties set forth herein. For example, the extensible outer cover **30** can be composed of a necked fabric, a creped fabric, a crimped fiber fabric, an extendable fiber fabric, a bonded-carded fabric, a micro-pleated fabric, polymer films or the like, as well as combinations thereof. The fabrics may be woven or nonwoven materials, such as spunbond fabrics. In a particular embodiment, the extensible outer cover **30** can be composed of an extensible laminate of two or more layers. For example, the extensible outer cover **30** may be a necked laminate formed from at least one neckable fabric laminated to at least one extendable film material wherein the necked laminate is extensible in at least one direction. The extensible outer cover **30** may otherwise be a laminate formed from at least one necked fabric laminated to at least one extendable film material. In such a configuration, the laminate need not be necked. For the purposes of the present description, the term "nonwoven web" means a web of fibrous material that is formed without the aid of a textile weaving or knitting process. The term "fabrics" is used to refer to all of the woven, knitted and nonwoven fibrous webs.

As used herein, the term "neck" or "neck stretch" interchangeably means that the fabric is drawn such that it is extended under conditions reducing its width or its transverse dimension by drawing and elongating to increase the length of the fabric. The controlled drawing may take place under cool temperatures, room temperature or greater temperatures and is limited to an increase in overall dimension in the direction being drawn up to the elongation required to break the fabric. The necking process typically involves unwinding a sheet from a supply roll and passing it through a brake nip roll assembly driven at a given linear speed. A take-up roll or nip, operating at a linear speed higher than the brake nip roll, draws the fabric and generates the tension needed to elongate and neck the fabric. U.S. Pat. No. 4,965,122 entitled REVERSIBLY NECKED MATERIAL, by M. T. Morman which issued Oct. 23, 1990, the entire disclosure of which is hereby incorporated by reference, discloses a process for providing a reversibly necked nonwoven material which may include necking the material, then heating the necked material, followed by cooling.

As used herein, the term "neckable material or layer" means any material which can be necked such as a nonwoven, woven, or knitted material. As used herein, the term "necked material" refers to any material which has been drawn in at least one dimension, (e.g. lengthwise), reducing the transverse dimension, (e.g. width), such that when the drawing force is removed, the material can be pulled back to its original width. The necked material typically has a higher basis weight per unit area than the un-necked material. When the necked material is pulled back to its original un-necked width, it should have about the same basis weight as the un-necked material. This differs from stretching/orienting a material layer, during which the layer is thinned and the basis weight is permanently reduced.

Typically, such necked nonwoven fabric materials are capable of being necked up to about 80 percent. For example, the extensible outer cover **30** of the various aspects of the present invention may be provided by a material that has been necked from about 10 to about 80 percent, desirably from about 20 to about 60 percent, and more desirably from about 30 to about 50 percent for improved performance. For the purposes of the present disclosure, the term "percent necked" or "percent neckdown" refers to a ratio or percentage determined by measuring the difference between the pre-necked dimension and the necked dimension of a neckable material, and then dividing that difference by the pre-necked dimension of the neckable material and multiplying by 100 for percentage. The percentage of necking (percent neck) can be determined in accordance with the description in the above-mentioned U.S. Pat. No. 4,965,122.

In a particular embodiment, the extensible outer cover **30** is made from a necked laminate material to provide the desired levels of extensibility as well as liquid impermeability and vapor permeability. For example, the extensible outer cover **30** may be a necked laminate formed from sheet layers of at least one neckable fabric laminated to at least one film material wherein the necked laminate is extensible in at least one direction and does not appreciably retract. Desirably, both the neckable fabric and the film material are non-elastic materials for increased permanent set, reduced cost and improved manufacturing efficiency.

By the term "non-elastic", what is meant is that the sheet layers are made from polymers that are generally considered to be inelastic. In other words, use of such inelastic polymers to form the sheet layers would result in sheet layers that are not elastic. As used herein, the term "elastic" means any material which, upon application of a biasing force, is

stretchable, that is, elongatable, at least about 60 percent (i.e., to a stretched, biased length which is at least about 160 percent of its relaxed unbiased length), and which will immediately recover at least 55 percent of its elongation upon release of the stretching, elongating force.

Suitable necked laminates that include at least one non-elastic neckable material laminated to at least one non-elastic film material are described in U.S. patent application Ser. No. 09/455,513 filed Dec. 6, 1999 and entitled "TRANSVERSELY EXTENSIBLE AND RETRACTABLE NECKED LAMINATE OF NON-ELASTIC SHEET LAYERS", the entire disclosure of which is hereby incorporated by reference.

In such a configuration, the non-elastic film layer can be made from either cast or blown film equipment, can be coextruded and can be embossed if so desired. The film layer may be made from any suitable non-elastic polymer composition and may include multiple layers. The non-elastic film layer can also be breathable. For example, the non-elastic film layer may contain such fillers as micropore developing fillers, e.g. calcium carbonate; opacifying agents, e.g. titanium dioxide; and antiblock additives, e.g. diatomaceous earth. Suitable polymers for the non-elastic film layer include but are not limited to non-elastic extrudable polymers such as polyolefin or a blend of polyolefins, nylon, polyester and ethylene vinyl alcohol. More particularly, useful polyolefins include polypropylene and polyethylene. Other useful polymers include those described in U.S. Pat. No. 4,777,073 to Sheth, assigned to Exxon Chemical Patents Inc., such as a copolymer of polypropylene and low density polyethylene or linear low density polyethylene.

Alternative polymers for the film layer include those referred to as single site catalyzed polymers such as "metallocene" polymers produced according to a metallocene process and which have limited elastic properties. The term "metallocene-catalyzed polymers" as used herein includes those polymer materials that are produced by the polymerization of at least ethylene using metallocenes or constrained geometry catalysts, a class of organometallic complexes, as catalysts. For example, a common metallocene is ferrocene, a complex of a metal between two cyclopentadienyl (Cp) ligands. Such metallocene polymers are available from Exxon Chemical Company of Baytown, Tex. under the trade name EXXPOL® for polypropylene based polymers and EXACT® for polyethylene based polymers and from Dow Chemical Company of Midland, Mich. under the name ENGAGE®. Preferably, the metallocene polymers are selected from copolymers of ethylene and 1-butene, copolymers of ethylene and 1-hexene, copolymers of ethylene and 1-octene and combinations thereof.

Suitable non-elastic neckable materials for such a configuration include nonwoven webs, woven materials and knitted materials such as those described in the above-mentioned U.S. Pat. No. 4,965,122. Nonwoven fabrics or webs have been formed from many processes, for example, bonded carded web processes, meltblowing processes and spunbonding processes. The non-elastic neckable material is preferably formed from at least one member selected from fibers and filaments of inelastic polymers. Such polymers include polyesters, for example, polyethylene terephthalate, polyolefins, for example, polyethylene and polypropylene, polyamides, for example, nylon 6 and nylon 66. These fibers or filaments are used alone or in a mixture of two or more thereof. Suitable fibers for forming the neckable material include natural and synthetic fibers as well as bicomponent, multi-component, and shaped polymer fibers. Many polyolefins are available for fiber production according to the present invention, for example, fiber forming polypropylenes include Exxon Chemical Company's Escorene® PD 3445 polypropylene and Himont Chemical Company's PF-304. Polyethylenes such as Dow Chemical's ASPUN® 6811A linear low density polyethylene, 2553 LLDPE and 25355 and 12350 high density polyethylene are also suitable polymers. The nonwoven web layer may be bonded to impart a discrete bond pattern with a prescribed bond surface area. If too much bond area is present on the neckable material, it will break before it necks. If there is not enough bond area, then the neckable material will pull apart. Typically, the percent bonding area useful in the present invention ranges from around 5 percent to around 40 percent of the area of the neckable material.

The non-elastic film layer may be laminated to the neckable material to form the laminate by conventional methods known in the art including adhesive bonding, point bonding, thermal point bonding, and sonic welding. The laminate is then necked by conventional necking processes that typically vary the surface speed of the web to draw or neck the laminate. Such necking provides striated rugosities in the film and/or laminate resulting in transverse extensibility and retractability to the necked laminate and more "cloth-like" aesthetics. It is known that stretching and orienting a filled film layer causes micropores to form in the film, but longitudinal striated rugosities do not typically form in the film layer when stretched. The film layer would instead become physically thinner and may narrow slightly. By necking the laminate, the non-elastic neckable material, which is attached to the non-elastic film layer, will neck and bring the non-elastic film layer with it, thereby forming the longitudinal striated rugosities in the film which allow the film layer to extend in the transverse direction.

Alternative necked laminate materials that could be used to provide the outer cover **30** of the different aspects of the present invention are described in U.S. patent application Ser. No. 09/460,490 filed Dec. 14, 1999 and entitled "BREATHABLE LAMINATE PERMANENTLY CONFORMABLE TO THE CONTOURS OF A WEARER", the entire disclosure of which is hereby incorporated by reference.

The bodyside liner **32**, as representatively illustrated in FIG. **1**, presents a body-facing surface that is compliant, soft-feeling, and non-irritating to the wearer's skin. Further, the bodyside liner **32** can be less hydrophilic than absorbent, body **34**, and is sufficiently porous to be liquid permeable, permitting liquid to readily penetrate through its thickness to reach the absorbent composite. A suitable bodyside liner layer **32** may be manufactured from a wide selection of web materials, such as porous foams, reticulated foams, apertured plastic films, natural fibers (for example, wood or cotton fibers), synthetic fibers (for example, polyester or polypropylene fibers), or a combination of natural and synthetic fibers. The bodyside liner layer **32** is typically employed to help isolate the wearer's skin from liquids held in the absorbent body **34**.

Various woven and nonwoven fabrics can be used for bodyside liner **32**. For example, the bodyside liner may be composed of a meltblown or spunbonded web of the desired fibers, and may also be a bonded-carded-web. Layers of different materials that may have different fiber deniers can also be used. The various fabrics can be composed of natural fibers, synthetic fibers or combinations thereof. The bodyside liner **32** may be composed of a substantially hydrophobic material, and the hydrophobic material may optionally be treated with a surfactant or otherwise processed to impart a

desired level of wettability and hydrophilicity. In a particular embodiment of the invention, bodyside liner **32** is a nonwoven, spunbond polypropylene fabric composed of about 2.8–3.2 denier fibers formed into a web having a basis weight of about 22 gsm and density of about 0.06 gm/cc. The fabric can be surface treated with an operative amount of surfactant, such as about 0.28 percent Triton X-102 surfactant. The surfactant can be applied by any conventional means, such as spraying, printing, brush coating or the like.

In particular embodiments, the bodyside liner **32** is desirably extensible such that it is capable of extending with the outer cover **30** to assist in providing the improved fastening, fit and containment discussed above. For example, the bodyside liner **32** can be composed of various extensible materials such as a necked fabric, a creped fabric, a micropleated fabric, perforated polymer films or the like, as well as combinations thereof. The fabrics may be woven or nonwoven materials, such as spunbond fabrics, that may be elastic or non-elastic. Examples of suitable manufacturing techniques and suitable necked nonwoven fabric materials for such an extensible bodyside liner **32** are described in U.S. Pat. No. 4,965,122 entitled REVERSIBLY NECKED MATERIAL, by M. T. Morman which issued Oct. 23, 1990.

Desirably, the bodyside liner **32** is made from non-elastic neckable materials for reduced cost and improved manufacturing efficiency. Suitable non-elastic neckable materials for such a configuration include nonwoven webs, woven materials and knitted materials. Such webs can include one or more fabric layers. Nonwoven fabrics or webs have been formed from many processes, for example, bonded carded web processes, meltblowing processes and spunbonding processes. The non-elastic neckable material is preferably formed from at least one member selected from fibers and filaments of inelastic polymers. Such polymers include polyesters, for example, polyethylene terephthalate, polyolefins, for example, polyethylene and polypropylene, polyamides, for example, nylon 6 and nylon 66. These fibers, or filaments are used alone or in a mixture of two or more thereof. Suitable fibers for forming the neckable material include natural and synthetic fibers as well as bicomponent, multi-component, and shaped polymer fibers. Many polyolefins are available for fiber production according to the present invention, for example, fiber forming polypropylenes include Exxon Chemical Company's Escorene® PD 3445 polypropylene and Himont Chemical Company's PF-304. Polyethylenes such as Dow Chemical's ASPUN® 6811A linear low density polyethylene, 2553 LLDPE and 25355 and 12350 high density polyethylene are also suitable polymers. The nonwoven web layer may be bonded to impart a discrete bond pattern with a prescribed bond surface area. If too much bond area is present on the neckable material, it will break before it necks. If there is not enough bond area, then the neckable material will pull apart. Typically, the percent bonding area useful in the present invention ranges from around 5 percent to around 40 percent of the area of the neckable material.

For example, a particularly suitable extensible material for the bodyside liner **32** is a necked spunbond web of polypropylene fibers having a basis weight of from about 5 to about 30 gsm. Such a web may be necked up to about 80 percent.

The neckable material may be necked to form the extensible bodyside liner **32** by conventional necking processes that typically vary the surface speed of the web to draw or neck the material. Such necking will allow the material to extend and retract in the transverse direction. As discussed above, such necked nonwoven fabric materials typically are capable of being necked up to about 80 percent. For example, the extensible bodyside liner **32** of the various aspects of the present invention may be necked from about 10 to about 80 percent, desirably from about 20 to about 60 percent, and more desirably from about 30 to about 50 percent for improved performance.

In embodiments wherein the bodyside liner **32** is extensible, the bodyside liner can provide a substantially permanent deformation of at least about 10 percent, desirably at least about 20 percent, and more desirably at least about 30 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein. Substantially permanent deformations less than those set forth above may not provided the desired permanent deformation for improved fastening, containment and breathability discussed herein. In still other aspects, the bodyside liner **32** can provide a substantially permanent deformation of from about 10 to about 200 percent and desirably from about 20 to about 100 percent when subjected to the tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein. The extensible bodyside liner **32** may also provide an elongation of at least about 20 percent, desirably at least about 25 percent and more desirably at least about 30 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width of the test sample according to the Material Elongation and Deformation Tensile Test set forth herein for improved performance.

Desirably, both the outer cover **30** and the bodyside liner **32** are extensible as set forth above for improved fit and performance. In configurations wherein both the outer cover **30** and the bodyside liner **32** are extensible, the diaper **20** can provide improved fit, resistance to leakage and breathability as the bodyside liner **32** does not restrict the ability of the outer cover **30** to maintain the substantially permanent deformation.

The bodyside liner **32** and outer cover **30** are connected or otherwise associated together in an operable manner. As used herein, the term "associated" encompasses configurations in which bodyside liner **32** is directly joined to the outer cover **30** by affixing the bodyside liner **32** directly to the outer cover **30**, and configurations wherein the bodyside liner **32** is indirectly joined to the outer cover **30** by affixing the bodyside liner **32** to intermediate members which in turn are affixed to the outer cover **30**. The bodyside liner **32** and the outer cover **30** can, for example, be joined to each other in at least a portion of the diaper periphery by attachment mechanisms (not shown) such as adhesive bonds, sonic bonds, thermal bonds, pinning, stitching or any other attachment techniques known in the art, as well as combinations thereof.

For example, a uniform continuous layer of adhesive, a patterned layer of adhesive, a sprayed pattern of adhesive or an array of separate lines, swirls or spots of construction bonds may be used to affix the bodyside liner **32** to the outer cover **30**. It should be readily appreciated that the above-described attachment mechanisms may also be employed to suitably interconnect, assemble and/or affix together the various other component parts of the articles that are described herein.

The absorbent body **34** provides an absorbent structure for holding and storing absorbed liquids and other waste materials, such as the shown absorbent pad composed of selected hydrophilic fibers and high-absorbency particles.

The absorbent body **34** may also be extensible or elastic. The absorbent body **34** is positioned and sandwiched between the bodyside liner **32** and outer cover **30** to form the diaper **20**. The absorbent body **34** has a construction that is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining body exudates. It should be understood that, for purposes of this invention, the absorbent body may comprise a single, integral piece of material, or alternatively, may comprise a plurality of individual separate pieces of material which are operably assembled together.

Various types of wettable, hydrophilic fibrous material can be used to form the component parts of absorbent body **34**. Examples of suitable fibers include naturally occurring organic fibers composed of intrinsically wettable material, such as cellulosic fibers; synthetic fibers composed of cellulose or cellulose derivatives, such as rayon fibers; inorganic fibers composed of an inherently wettable material, such as glass fibers; synthetic fibers made from inherently wettable thermoplastic polymers, such as particular polyester or polyamide fibers; and synthetic fibers composed of a nonwettable thermoplastic polymer, such as polypropylene fibers, which have been hydrophilized by appropriate means. The fibers may be hydrophilized, for example, by treatment with silica, treatment with a material which has a suitable hydrophilic moiety and is not readily removable from the fiber, or by sheathing the nonwettable, hydrophobic fiber with a hydrophilic polymer during or after the formation of the fiber. For the purposes of the present invention, it is contemplated that selected blends of the various types of fibers mentioned above may also be employed.

As used herein, the term "hydrophilic" describes fibers or the surfaces of fibers that are wetted by the aqueous liquids in contact with the fibers. The degree of wetting of the materials can, in turn, be described in terms of the contact angles and the surface tensions of the liquids and materials involved. Equipment and techniques suitable for measuring the wettability of particular fiber materials or blends of fiber materials can be provided by a Cahn SFA-222 Surface Force Analyzer System, or a substantially equivalent system. When measured with such system, fibers having contact angles less than 90° are designated "wettable", while fibers having contact-angles greater than 90° are designated "nonwettable".

The absorbent body **34** can comprise a matrix of hydrophilic fibers, such as a web of cellulosic fluff, mixed with particles of high-absorbency material. In particular arrangements, the absorbent body **34** may comprise a mixture of superabsorbent hydrogel-forming particles or fibers and synthetic polymer meltblown fibers, or a mixture of superabsorbent particles or fibers with a fibrous coform material comprising a blend of natural fibers and/or synthetic polymer fibers.

The superabsorbent particles may be substantially homogeneously mixed with the hydrophilic fibers, or may be nonuniformly mixed. For example, the concentrations of superabsorbent particles may be arranged in a non-stepwise gradient through a substantial portion of the thickness (z-direction) of the absorbent body, with lower concentrations toward the bodyside of the absorbent body and relatively higher concentrations toward the garmentside of the absorbent body. Alternative distributions and methods of achieving such distributions are well known to this skilled in the art. The superabsorbent particles may also be arranged in a generally discrete layer within the matrix of hydrophilic fibers. In addition, two or more different types of superabsorbent may be selectively positioned at different locations within or along the fiber matrix.

The high-absorbency material may comprise absorbent gelling materials, such as superabsorbents. Absorbent gelling materials can be natural, synthetic and modified natural polymers and materials. In addition, the absorbent gelling materials can be inorganic materials, such as silica gels, or organic compounds such as cross-linked polymers. The term "cross-linked" refers to any means for effectively rendering normally water-soluble materials substantially water insoluble but swellable. Such means can include, for example, physical entanglement, crystalline domains, covalent bonds, ionic complexes and associations, hydrophilic associations, such as hydrogen bonding, and hydrophobic associations or Van der Waals forces.

Examples of synthetic absorbent gelling material polymers include the alkali metal and ammonium salts of poly (acrylic acid) and poly (methacryic acid), poly (acrylamides), poly(vinyl ethers), maleic anhydride copolymers with vinyl ethers and alpha-olefins, poly(vinyl pyrrolidone), poly(vinylmorpholinone), poly(vinyl alcohol), and mixtures and copolymers thereof. Further polymers suitable for use in the absorbent composite include natural and modified natural polymers, such as hydrolyzed acrylonitrile-grafted starch, acrylic acid grafted starch, methyl cellulose, chitosan, carboxymethyl cellulose, hydroxypropyl cellulose, and the natural gums, such as alginates, xanthan gum, locust bean gum and the like. Mixtures of natural and wholly or partially synthetic absorbent polymers can also be useful in the present invention. Synthetic absorbent gelling materials typically are xerogels which form hydrogels when wetted. The term "hydrogel", however, has commonly been used to also refer to both the wetted and unwetted forms of the material.

As mentioned previously, the high-absorbency material used in the absorbent body **34** is generally in the form of discrete particles. The particles can be of any desired shape, for example, spiral or semi-spiral, cubic, rod-like, polyhedral, etc. Shapes having a large greatest dimension/smallest dimension ratio, like needles, flakes, and fibers, are also contemplated for use herein. Conglomerates of particles of absorbent gelling material may also be used in absorbent body **34**. Desired for use are particles having an average size of from about 20 microns to about 1 millimeter. "Particle size" as used herein means the weighted average of the smallest dimension of the individual particles.

The hydrophilic fibers and high-absorbency particles can be configured to form an average composite basis weight which is within the range of about 400–900 gsm. In certain aspects of the invention, the average composite basis weight is within the range of about 500–800 gsm, and alternatively is within the range of about 550–750 gsm to provide desired performance.

Optionally, a substantially hydrophilic tissue wrapsheet may be employed to help maintain the integrity of the fibrous structure of the absorbent body **34**. The tissue wrapsheet is typically placed about the absorbent body over at least the two major facing surfaces thereof and composed of an absorbent cellulosic material, such as creped wadding or a high wet-strength tissue that may or may not be pleated. In one aspect of the invention, the tissue wrapsheet can be configured to provide a wicking layer which helps to rapidly distribute liquid over the mass of absorbent fibers comprising the absorbent body **34**. The wrapsheet material on one side of the absorbent fibrous mass may be bonded to the wrapsheet located on the opposite side of the fibrous mass to effectively entrap the absorbent body **34**.

With reference to FIGS. **1** and **2**, each of the leg elastic members **36** can include a plurality of elastomeric strands.

Optionally, each leg elastic member may be a composite that includes at least one carrier layer (not shown), and the elastomeric strands can be operatively attached to the carrier layer. Various mechanisms, such as adhesive, thermal bonds, sonic bonds, or the like as well as combinations thereof, can be employed to provide the desired attachments between the elastomeric strands and the carrier layer. For example, each leg elastic member may be composed of a laminate of a plurality of elastomeric strands sandwiched and held between a pair of carrier layers. The carrier layers may desirably be composed of a woven or nonwoven fabric having a basis weight within the range of about 10–50 g/m^2, but may optionally be composed of a polymer film material. For example, the carrier layers may be composed of a polypropylene spunbond nonwoven fabric, and the pair of carrier layers may be adhesively bonded together with a suitable pattern of adhesive, such as a swirl-pattern of pressure-sensitive adhesive.

The leg elastic members **36** may have any of a multitude of configurations. For example, the width of the individual elastic members **36** may be varied from about 0.25 millimeters (0.01 inch) to about 25 millimeters (1.0 inch) or more. The elastic members may comprise a single strand of elastic material, or may comprise several parallel or non-parallel strands of elastic material, or may be applied in a rectilinear or curvilinear arrangement. Where the strands are non-parallel, two or more of the strands may intersect or otherwise interconnect within the elastic member. The elastic members may be affixed to the outer cover **30** and/or bodyside liner **32** of the diaper **20** in any of several ways that are known in the art. For example, the elastic members may be ultrasonically bonded, heat and pressure sealed using a variety of bonding patterns, or adhesively bonded to the diaper with sprayed or swirled patterns of adhesive.

In particular embodiments of the invention, the leg elastic members **36** may include a carrier sheet to which are attached a grouped set of elastics composed of a plurality of individual elastic strands. The elastic strands may intersect or be interconnected, or be entirely separated from each other. The carrier sheet may, for example, comprise a 0.002 inch thick polymer film, such as a film of unembossed polypropylene material. The elastic strands can, for example, be composed of LYCRA elastomer available from DuPont, a business having offices in Wilmington, Del. Each elastic strand is typically within the range of about 470–1500 decitex (dtx), and may be about 940–1050 dtx. In particular embodiments of the invention, for example, three or four strands can be employed for each elasticized leg-band.

In addition, the leg elastics **36** may be generally straight or optionally curved. For example, the curved elastics can be inwardly bowed toward the longitudinal centerline of the diaper. In particular arrangements, the curvature of the elastics may not be configured or positioned symmetrically relative to the lateral centerline of the diaper. The curved elastics may have an inwardly bowed and outwardly bowed, reflex-type of curvature, and the length-wise center of the elastics may optionally be offset by a selected distance toward either the front or rear waistband of the diaper to provide desired fit and appearance. In particular embodiments of the invention, the innermost point (apex) of the set of curved elastics can be offset towards the front or rear waistband of the diaper, and the outwardly bowed reflexed-portion can be positioned toward the diaper back waistband.

As discussed above, the forces exerted on the outer cover **30** when fastening the diaper **20** about the wearer's waist are typically localized in one or both of the front and rear waist sections **22** and **24** of the diaper **20** and generally do not substantially affect the intermediate section **26** of the diaper **20**. As a result, the extension of the fasteners **40** upon the initial fastening about the wearer tends to cause the outer cover **30** in one or both of the front and rear waist sections **22** and **24** to extend and permanently deform. Such permanent deformation of the outer cover **30** in one or both of the waist sections results in an increase in the lateral distance between the leg elastics **36** toward such waist section. This increase in lateral distance between the leg elastics **36** in at least one of the waist sections **22** and **24** desirably occurs without a substantial increase in the lateral distance between the leg elastics **36** in the intermediate section **26** of the diaper **20** upon the fastening of the diaper **20** about the wearer. Such an increase in the curvature of the leg elastics **36** can result in configurations that were not practical with known manufacturing processes. The increase in curvature also allows the leg elastics to more closely conform to the wearer and can provide greater coverage over the hip regions of the wearer. Such improved fit and coverage can result in a reduced incidence of leakage. Moreover, diapers that are not extendable and, in particular, the leg elastics on such diapers can be very constrictive on the wearer's body during use undesirably leading to discomfort and potential skin irritation. Whereas, the extendability of the diaper of the different aspects of the present invention relieves such constriction and expands to improve fit and comfort.

For example, as illustrated in FIGS. **6** and **7**, the extensible outer cover **30** may define a non extended distance **60** between the fasteners **40** prior to use and an extended distance **62** after the fasteners **40** are extended in use to fasten the article about the waist of the wearer. As can be seen in the illustrated embodiment, the extension of the fasteners **40** in the lateral direction **50** extends and permanently deforms the outer cover **30** in the rear waist section **24** between the fasteners **40** but does not result in any substantial extension and permanent deformation of the outer cover **30** along the lateral centerline **52** of the diaper **20**. As a result, in use, the leg elastics **36** of the diaper **20** can permanently deform with the outer cover **30** toward at least one of the waist sections **22** and **24** to provide enhanced curvature. For example, as representatively illustrated in FIGS. **6** and **7**, the distance between the innermost edges of the leg elastics **56** in the lateral direction **50** may define a first dimension **64** before the fasteners **40** are extended and a second dimension **66** after the fasteners **40** have been extended upon the fastening of the diaper **20** on the wearer wherein the second dimension **66** is greater than the first dimension **64**.

As a result, the diaper **20** of the different aspects of the present invention desirably provides increased curvature of the leg elastics in the waist sections **22** and **24** of the diaper **20** in use. A suitable method of predicting such levels of increased curvature of the leg elastics during use is the Product Deformation Test described herein. In general, the lateral width of the article in the non-extended condition is measured along a lateral line located about 40% of the distance between the centerline of the fasteners and the lateral centerline **52** of the article and recorded. The fasteners **40** on the diaper **20** are then subjected to four cycles of a tensile force of 2000 gmf in the lateral direction **50** each held at that extension for a period of 1 minute, and then allowed to relax, after a removal of the cyclic tensile force, for a period of at least 24 hours. The lateral width of the article in the same location is then measured and recorded and compared to the initial non-extended lateral width.

Desirably, the article of the present invention provides a permanent leg elastic deformation of at least about 3 percent,

more desirably at least about 4 percent, even more desirably at least about 6 percent, and even more desirably at least about 10 percent when subjected to the Product Deformation Test. For example, the article of the present invention can provide a permanent leg elastic deformation of from about 3 to about 30 percent for improved performance. Permanent leg elastic deformations less than those set forth above may not provide the desired level of increased leg curvature and hip coverage in use.

As representatively illustrated in FIGS. **1** and **2**, the absorbent article of the present invention also includes a pair of fasteners such as hook and loop fasteners **40**. The fasteners **40** can be located at either or both of the front and rear waist sections **22** and **24**. For example, in the representatively shown embodiment, each of the hook fasteners **40** are assembled and attached to extend from the side panels **42** that are attached to the laterally opposed side edges in the rear waist section **24**.

In the various configurations of the invention, the fasteners **40** may include an adhesive, a cohesive, a complementary element of an interengaging mechanical fastening system, or the like, as well as combinations thereof. The mechanical fastener components can be provided by mechanical-type fasteners such as hooks, buckles, snaps, buttons and the like, which include cooperating and complementary, mechanically interlocking components. For example, as illustrated, the fasteners **40** may be a hook fastener of a hook-and-loop type of fastening system. Such fastening systems generally comprise a "hook" or hook-like, male component, and a cooperating "loop" or loop-like, female component which engages and releasably interconnects with the hook component. Desirably, the interconnection is selectively releasable and re-attachable.

Conventional hook and loop fastening systems are, for example, available under the VELCRO trademark. In a particular embodiment, the fasteners **40** may be a microhook material such as that distributed under the designation CS200 by 3M Company, a business having offices in St. Paul, Minn. Another suitable micro-hook material is distributed under the designation VELCRO CFM-29 1058, and is available from VELCRO U.S.A., Inc., a business having offices in Manchester, N.H.

The loop element may be provided directly by the outer cover **30** of the diaper **20** to provide a "fasten anywhere" mechanical fastening system for improved fastening. Alternatively, the diaper **20** may include one or more attachment panels (not illustrated) to which the fasteners **40** are configured to releasably engage. For example, when the fasteners **40** are hook fasteners located in the rear waist section **24** of the diaper **20** as illustrated, the diaper may include a corresponding attachment panel such as a complementary loop element on the outward facing surface in the front waist section **22**. The attachment panels may be provided by a woven fabric, a nonwoven fabric, a knitted fabric, a perforated or apertured layer, and the like, as well as combinations thereof. For example, a suitable material for the attachment panel can be composed of a 2 bar, warp knit fabric of the type available from Guilford Mills, Inc., Greensboro, N.C. under the trade designation #34285, as well other of knit fabrics.

With reference to the representative configurations shown in FIGS. **1** and **2**, the article can also include side panels **42**. In particular arrangements, each side panel **42** extends laterally at the opposed, lateral ends of at least one waist section of the diaper **20**, such as the representatively shown rear waist section **24**, to provide terminal side sections of the article. In addition, each side panel **42** can substantially span from a laterally extending, terminal waist edge to approximately the location of its associated and corresponding leg opening section of the diaper. The diaper **20**, for example, has a laterally opposed pair of leg openings provided by the curved margins of the side panels **42** in combination with the correspondingly adjacent, medial sections of the shown pair of longitudinally extending, side edges in the intermediate section **26** of the diaper **20**.

In the various configurations of the invention, the side panels **42** may be integrally formed with a selected diaper component. For example, the side panels **42** can be integrally formed from the layer of material that provides the outer cover **30**, or may be integrally formed from the material employed to provide the bodyside liner **32**. In alternative configurations, the side panels **42** may be provided by one or more separately provided members that are connected and assembled to the outer cover **30**, to the bodyside liner **32**, in between the outer cover and bodyside liner, or in various fixedly attached combinations of such assemblies.

In particular configurations of the invention, each of the side panels **42** may be formed from a separately provided piece of material which is then suitably assembled and attached to the selected front and/or rear waist section of the article. For example, each side panel **42** may be attached to the rear waist section of the diaper **20**, and can be operably attached to either or both of the outer cover **30** and bodyside liner **32** components of the article. The inboard, attachment zone region of each side panel can be overlapped and laminated with its corresponding, lateral end edge region of the waist section of the article. The side panels **42** extend laterally and are attached with suitable connecting means, such as adhesive bonding, thermal bonding, ultrasonic bonding, clips, staples, sewing or the like. Desirably, the side panels **42** extend laterally beyond the terminal side edges of the outer cover **30** and bodyside liner **32** at the corresponding waist section of the article.

The side panels **42** may be composed of a substantially non-elastomeric material, such as polymer films, woven fabrics, nonwoven fabrics or the like, as well as combinations thereof. In particular aspects of the invention, the side panels **42** may be composed of a substantially elastomeric material, such as a stretch-bonded-laminate (SBL) material, a neck-bonded-laminate (NBL) material, an elastomeric film, an elastomeric foam material, or the like, which is elastomerically stretchable at least along the lateral direction **50**.

The different aspects of the present invention advantageously provide absorbent articles that have an extensible outer cover that provides improved fit and improved resistance to leakage. In particular, the extensible outer cover is capable of adjusting to the wearer's movements and changes in body dimensions for improved performance. In addition, the extensible outer cover on the articles provides improved breathability, greater softness, and more cloth-like properties. Moreover, in certain aspects, the present invention can also advantageously provide pant-like, prefastened, absorbent articles that are capable of being reliably pulled up or down over the hips of the wearer to assist in the toilet training of the wearer similar to conventional training pants.

Further, the different embodiments of the present invention, advantageously provide absorbent articles which exhibit a breathability gradient that can lead to substantially reduced levels of hydration of the wearer's skin and reduced clothing dampness when in use compared to conventional absorbent articles. The reduced levels of skin hydration promote drier, more comfortable skin and render the skin

less susceptible to the growth of microorganisms. Thus, wearer's of absorbent articles made according to the present invention have reduced skin hydration that can lead to a reduction in the incidence of skin irritation and rash.

TEST PROCEDURES

Material Elongation and Deformation Tensile Test

A suitable technique for determining the amount of elongation, retractive force and or permanent deformation of a selected component or material can employ ASTM Standard Test Method D882 (Tensile Method for Tensile Properties of Thin Plastic Sheeting) dated December 1995, with the following particulars.

Equipment

1. Tensile tester capable of obtaining a peak load and equipped with an appropriate load cell. A suitable tensile testing system is a Sintech Tensile Tester, commercially available from MTS Sintech, Research Triangle Park, North Carolina, under the trade designation Model 1/G equipped with Sintech Testworks™ Version 3.10 Software.
2. Pneumatic-action grips having a 0.5 by 4 inch grip face.
3. Test facility having a temperature of 23±1° C., and a relative humidity of 50±2 percent.

The test sample width is perpendicular to the direction of the tensile force applied during the testing. With regard to the shown configurations, for example, the test sample "width" generally corresponds to the length-wise dimension of outer cover **30** along the longitudinal direction **48** of the article. The initial separation of the jaws of the tensile tester is 3 inches (76.2 mm) at a tensile force of about 1 gram force per inch of width of the test sample, and the moving jaw is moved at a constant rate of 127 mm/min. The moving jaw is stopped at an extension where the tensile force equals 100 grams force per inch of width of the test sample, held at that extension for a period of 2 minutes, and then returned back to its initial tensile force of about 1 gram force per inch of width of the test sample at a rate of 127 mm/min.

The percentage of elongation, extension or permanent deformation can be determined in accordance with the following formula:

$$100*(L-L_o)/(L_o);$$

where:

L=either a) extended length for elongation or extension or b) post extended length for set or deformation, and

L_o=initial length.

Mocon Water Vapor Transmission Rate Test

A suitable technique for determining the WVTR (water vapor transmission rate) value of a material is the test procedure standardized by INDA (Association of the Nonwoven Fabrics Industry), number IST-70.4-99, entitled "STANDARD TEST METHOD FOR WATER VAPOR TRANSMISSION RATE THROUGH NONWOVEN AND PLASTIC FILM USING A GUARD FILM AND VAPOR PRESSURE SENSOR" which is incorporated by reference herein. The INDA procedure provides for the determination of WVTR, the permeance of the film to water vapor and, for homogeneous materials, water vapor permeability coefficient.

The INDA test method is well known and will not be set forth in detail herein. However, the test procedure is summarized as follows. A dry chamber is separated from a wet chamber of known temperature and humidity by a permanent guard film and the sample material to be tested. The purpose of the guard film is to define a definite air gap and to quiet or still the air in the air gap while the air gap is characterized. The dry chamber, guard film, and the wet chamber make up a diffusion cell in which the test film is sealed. The sample holder is known as the Permatran-W model 100K manufactured by Mocon/Modem Controls, Inc, Minneapolis, Minn. A first test is made of the WVTR of the guard film and air gap between an evaporator assembly that generates 100 percent relative humidity. Water vapor diffuses through the air gap and the guard film and then mixes with a dry gas flow which is proportional to water vapor concentration. The electrical signal is routed to a computer for processing. The computer calculates the transmission rate of the air gap and guard film and stores the value for further use.

The transmission rate of the guard film and air gap is stored in the computer as CalC. The sample material is then sealed in the test cell. Again, water vapor diffuses through the air gap to the guard film and the test material and then mixes with a dry gas flow that sweeps the test material. Also, again, this mixture is carried to the vapor sensor. The computer then calculates the transmission rate of the combination of the air gap, the guard film, and the test material. This information is then used to calculate the transmission rate at which moisture is transmitted through the test material according to the equation:

$$TR^{-1}_{test\ material}=TR^{-1}_{test\ material,\ guardfilm,\ airgap}-TR^{-1}_{guardfilm,\ airgap}$$

Calculations:

WVTR: The calculation of the WVTR uses the formula:

$$WVTR=F\rho_{sat}(T)RH/A\rho_{sat}(T)(1-RH))$$

where:

F=The flow of water vapor in cc/min.,

$\rho_{sat}(T)$=The density of water in saturated air at temperature T,

RH=The relative humidity at specified locations in the cell,

A=The cross sectional area of the cell, and,

$\rho_{sat}(T)$=The saturation vapor pressure of water vapor at temperature T.

Product Deformation Test

A suitable technique for determining the deformation and the resulting increased breathability and leg elastic curvature of the article of the present invention when fastened about the wearer can employ the following test procedure. In general, a series of measurements are obtained on the article and, in particular, on the extensible outer cover of the article both before and after the fasteners **40** on the article are subjected to four cycles of a lateral tensile force of 2000 gmf in the lateral direction **50**, each cycle being held at the extension where the tensile force reaches 2000 gmf for a period of 1 minute.

Sample Preparation

1. The product sample is clamped in a conventional vertical lightbox by hanging the product vertically with the rear waist section **24** of the product at the top of the lightbox and the outer cover **30** of the sample facing the viewer.
2. The top clamp is laterally centered on the end edge of the product.
3. A bottom clamp weighing 1000 grams is attached to the end edge of the product in the front waist section **22** and allowed to hang freely.

4. With the product hanging, the following measurements and markings as illustrated in FIG. **8** are determined, recorded and marked on the outer cover **30** of the article.
5. Measure and mark the lateral centerline **52** of the product my measuring the total length of the product in the longitudinal direction **48**, marking the centerpoint and constructing the lateral centerline **52** perpendicular to the longitudinal direction **48**.
6. Measure and mark the longitudinal centerline **54** of the product my measuring the total width of the product in the lateral direction **50** along the lateral centerline **52**, marking the centerpoint **84** and constructing the longitudinal centerline **54** perpendicular to the lateral centerline **52**.
7. Measure the inboard longitudinal edge **80** of the fasteners **40**, mark the center of the inboard edge **80** of the fasteners, and draw a line between the centers to provide the centerline **82** of the fasteners **40** which intersects the longitudinal centerline **54** at point **86**.
8. Measure the distance between points **84** and **86** along the longitudinal centerline **54**, and mark the position **88** at a location from point **84** along the longitudinal centerline **54** a distance equal to 40% of the distance between points **84** and **86** along the longitudinal centerline **54**.
9. Construct a lateral line **90** through point **88** and perpendicular to the longitudinal centerline **54**.
10. The points at which the lateral line **90** intersects the side edges of the product are marked **92** and **94**, respectively, and the distance between **92** and **94** is measured and recorded.

Equipment

1. Tensile tester capable of obtaining a peak load and equipped with an appropriate load cell. A suitable tensile testing system is a Sintech Tensile Tester, commercially available from MTS Sintech, Research Triangle Park, North Carolina, under the trade designation Model 1/G equipped with Sintech Testworks™ Version 3.10 Software.
2. Pneumatic-action grips having 0.5 by 4 inch grip faces.
3. Test facility having a temperature of 23±1° C., and a relative humidity of 50±2 percent.

Test Procedure

1. A product to be tested is conditioned in the test facility for at least 4 hours prior to testing.
2. The load cell is calibrated and the software loaded.
3. The grips are installed on the tensile tester with the jaws closed.
4. One of the fasteners **40** of the article is inserted into the upper jaw such that the edge of the grip face is flush with the inboard edge **80** of the fastener material.
5. Tare the weight of the clamp and the product out.
6. Align the lower jaw with the inboard edge **80** of the opposite fastener **40** and close it.
7. Adjust the initial tensile load on the product to be 5 gmf by adjusting the upper jaw position.
8. Activate the upper jaw so that it travels away from the lower jaw at a constant speed of 127 mm/min.
9. The movement of the upper jaw stops when the tensile load on the product is 2000 gmf.
10. Hold the extension for a period of 1 minute before returning the upper jaw to its initial position at a constant speed of 127 mm/min.
11. The upper jaw holds at the initial position for a period of 1 minute.
12. Repeat steps 8–11 three additional times.
13. Remove the product from the tester.

Leg Elastic Deformation

After removal from the tester, the product is allowed to relax for a period of at least 24 hours. The product is then placed on the lightbox following the sample preparation procedures set forth above. The post extended distance between points **92** and **94** is measured. The percent permanent leg elastic deformation value is then determined by subtracting the initial distance between points **92** and **94** from the post extended distance, then dividing by the initial distance and multiplying by 100 in accordance with the following formula:

$$100*(D-D_o)/(D_o);$$

where:

D=post extended distance, and

D_o=initial distance

Breathability Enhancement

After removal from the tester, the product allowed to relax for a period of at least 24 hours.

To determine the longitudinal breathability gradient ratio, a portion of the outer cover material centered about point **86** (i.e. the intersection of the longitudinal centerline **54** of the article and a lateral line **82** between the center of the fasteners **40**) is removed. In addition, a portion of the outer cover material centered about point **84** (i.e. the intersection of the longitudinal **54** and lateral centerlines **52** in the intermediate section **26** of the article) is also removed. Both portions are subjected to the Mocon Water Vapor Transmission Test set forth herein and the results are recorded. The longitudinal breathability gradient ratio of the outer cover **30** is then determined by dividing the breathability of the portion of the outer cover **30** taken between the fasteners by the portion of the outer cover taken from the intermediate section **26** of the article.

To determine the lateral breathability gradient ratio, a portion of the outer cover material centered about point **86** (i.e. the intersection of the longitudinal centerline **54** of the article and a lateral line **82** between the center of the fasteners **40**) is removed. In addition, a portion of the outer cover material nearest the fasteners along the laterally opposed side edges of the article and centered about the lateral line **82** between the center of the fasteners **40** is also removed. Both portions are subjected to the Mocon Water Vapor Transmission Test set forth herein and the results are recorded. The lateral breathability gradient ratio of the outer cover **30** is then determined by dividing the breathability of the portion of the outer cover **30** taken adjacent the fasteners by the portion of the outer cover taken from along the longitudinal centerline of the article between the fasteners.

EXAMPLES

The following examples are presented to provide a more detailed understanding of the invention. The examples are representative, and are not intended to limit the scope of the invention

Example 1

A necked laminate suitable for the extensible outer cover of the present invention was prepared from a non-elastic film layer and a non-elastic nonwoven web layer. A 1.5 mil layer

of blown film made of 48 percent by weight (25 volume percent) SUPERCOAT calcium carbonate as manufactured by English China Clay America, Inc. of Sylacauga, Ala., 47 percent by weight (68 volume percent) linear low density polyethylene (LLDPE) available under the trade designation DOWLEX NG3347A as manufactured by the Dow Chemical Company ("Dow"), 5 percent by weight (7 volume percent) low density polyethylene (LDPE) available under the trade designation 6401 as manufactured by Dow, and 2000 ppm antioxidant stabilizer available under the trade designation B900 as manufactured by Ciba Specialties Company of Tarrytown, N.Y. The film layer, made of the composition as described above, was pre-made and wound onto a roll. The film layer was then unwound from a film unwind unit into a conventional machine direction orienter, such as that manufactured by the Marshall and Williams Company, where it was partially stretched in the machine direction to form a partially stretched, breathable film layer.

Likewise, a 0.4 osy basis weight standard polypropylene spunbond having a wireweave bond pattern, such as that available from the Kimberly-Clark Corporation of Dallas, Tex., was unwound and an adhesive of 3 gsm weight (at the application point) available as H2525A from Ato-Findley of Wauwatosa, Wis. was applied to one surface of the nonwoven web layer using an air assisted spraying device such as a meltblown device. Such devices are generally described in, for example, commonly assigned U.S. Pat. No. 4,949,668 to Heindel et al.; U.S. Pat. No. 4,983,109 to Miller et al., assigned to Nordson Corporation; and U.S. Pat. No. 5,728,219 to Allen et al., assigned to J&M Laboratories, Inc.

The adhesive side of the nonwoven web layer was then laminated to the partially stretched film layer using laminating rollers at a pressure of 30 pli (5.4 kg/linear cm) of a smooth resilient (rubber coated) anvil roll on one side and a smooth, unheated steel roll. The laminate was then stretched in the longitudinal dimension and necked in the transverse dimension by passing it through a stretch nip at a greater speed than the speed of the laminating rollers. The necking draw caused contraction (necking) of the laminate in the transverse direction. The laminate was necked 33 percent (i.e. to about two thirds of the laminates pre-stretched width).

Samples of the outer cover material described in Example 1 were tested and compared to samples of outer cover material from HUGGIES Ultratrim diapers commercially available from Kimberly-Clark Corporation and PAMPERS Baby Dry diapers commercially available from The Procter and Gamble Company. The outer cover material from the diaper samples was obtained by measuring the length of the diaper in the longitudinal direction **48** (FIG. 1) and obtaining a sample from a location offset from the waist edge of the diaper in the rear waist section **24** a distance equal to 25 percent of the diaper length.

Six samples of the outer cover materials were then subjected to the Material Elongation and Deformation Tensile Test set forth above. The results of such test are set forth in Table 1 below. The initial distance between the jaws of the tensile tester for each sample was 76.2 mm at an initial force of 1 gmf per inch of width.

TABLE 1

Material	Extended Length @ 100 gmf per inch (mm)	Postextended Length @ 1 gmf per inch (mm)	Percent Elongation	Percent Permanent Deformation
Example 1	102.7	97.0	34.8%	27.3%
HUGGIES	77.2	76.7	1.4%	0.6%
PAMPERS	96.0	87.8	26.0%	15.3%

The results show that the outer cover material of Example 1 exhibits greater elongations and deformation than the outer cover material from conventional diapers. The combination of high elongation and high deformation or set of the outer cover material of Example 1 can provide a diaper that "gives" when cross directional forces are exerted on the outer cover material during fastening and wear. Thus, such an outer cover can more readily conform and adjust to the changing body dimensions of the wearer as they move for improved fit and reduction in leakage. Moreover, such an outer cover can also readily expand as the absorbent body in the diaper receives repeated insults and expands to provide more void volume in the diaper for improved containment.

Example 2

Necked laminates suitable for the extensible outer cover of the present invention were prepared from two different film layers (Material A and Material B) each individually laminated to a non-elastic nonwoven web layer.

Material A included a 1.8 mil layer of blown film made of 52% by weight calcium carbonate, and 48% by weight of a polymer combination. The polymer combination included 41.7% by weight DOW EG-8200, single-site catalyzed very low density polyethylene having a density of 0.87 grams per cubic centimeter and an octene comonomer available from Dow Chemical Company ("Dow"). The polymer combination also included 58.3% by weight DOWLEX 2517, a Ziegler-Natta catalyzed linear low density polyethylene (LLDPE) having a density of 0.917 grams per cubic centimeter available from Dow.

Material B included a 1.8 mil layer of blown film made of 52 percent by weight calcium carbonate and 48 percent by weight of a polymer combination. The polymer combination included 20.3 percent by weight DOW EG-8200 and 79.7 percent by weight DOWLEX 2517 available from Dow.

The film layers, made of the composition as described above, were pre-made and wound onto a roll. The film layers were then unwound from a film unwind unit into a conventional machine direction orienter, such as that manufactured by the Marshall and Williams Company, where they were stretched in the machine direction to four times their original length to form a stretched, breathable film layer. A 21 gsm basis weight, 33 percent necked, polypropylene spunbond material was unwound and an adhesive of 3 gsm weight (at the application point) available as H2525A from Ato-Findley of Wauwatosa, Wis. was applied to one surface of the nonwoven web layer using an air assisted spraying device such as a meltblown device. The adhesive side of the nonwoven web layer was then laminated to each of the stretched film layers using laminating rollers at a pressure of 30 pli (5.4 kg/linear cm) of a smooth resilient (rubber coated) anvil roll on one side and a smooth, unheated steel roll.

Material A and Material B were then subjected to the Mocon Water Vapor Transmission Rate Test set forth above

both in a non-extended condition and while being held at an extension of 25 percent in the cross machine direction. The results are set forth below in Table 2.

TABLE 2

Laminate	WVTR @ 0% Extension	WVTR @ 25% Extension	Percent Increase
Material A	800	7000	675%
Material B	19000	37000	95%

The results show that the outer cover materials of Example 2 exhibit substantial increases in breathability when subjected to fairly low extensions. As a result, articles incorporating such materials should exhibit enhanced breathability in use for improved performance.

Examples 3–6

Examples of diapers of the present invention including the outer cover materials described in Examples 1 and 2 were tested to determine the leg elastic deformation and compared to Step 4 sized HUGGIES Ultratrim diapers commercially available from Kimberly-Clark Corporation and Extra Large PAMPERS Baby Dry diapers commercially available from The Procter and Gamble Company.

The Example 1 and 2 diapers provided a "size 4" diaper for an infant weighting between 22 and 37 pounds. The diapers had the configurations and shapes illustrated in FIGS. **1** and **2**.

The outer cover **30** included the extensible materials set forth in Examples 1 and 2. The bodyside liner **32** included a standard polypropylene spunbond material having a basis weight of 0.6 osy that was neck stretched 45 percent. The absorbent body **34** included a pleated cellulose tissue wrap sheet that was overlaid onto an absorbent core comprising a mixture of 40 percent cellulosic, woodpulp fluff and 60% superabsorbent polymer (FAVOR SXM-880 from Stockhausen). A layer of surge material **44** was placed between the absorbent **34** and the bodyside liner **32**. The surge layer had a basis weight of about 3.55 osy. The surge layer measured 51 mm in the lateral direction and 178 mm in the longitudinal direction. Another layer of necked SMS material having a basis weight of 0.8 osy was placed between the absorbent **34** and the outer cover **30**. The SMS layer measured 51 mm in the lateral direction and 388 mm in the longitudinal direction.

In the machine made diapers, the outer cover **30** was adhesively attached to the necked SMS material and the tissue wrap sheet on the garment facing surface of the absorbent body **34** using pressure sensitive, hot melt adhesive at an add-on rate of about 3 gsm. The adhesive was deposited in the form of adhesive swirls across the entire mating surface. The layers are bonded together by passing the composite through a nip while the adhesive is still warm enough to effect bonding.

In the hand made diapers, the outer cover **30** was adhesively attached to the SMS material and the tissue wrap sheet on the garment facing surface of the absorbent body **34** using pressure sensitive, hot melt adhesive at an add-on rate of about 5 gsm. In the rear waist section, the adhesive was deposited in the form of a continuous band on and around the perimeter of the SMS material in a picture frame like pattern.

The diaper also had a pair of leg elastics **36**. Each leg elastic member **36** included three, 620 dtx (decitex) elastomeric strands **98** composed of LYCRA XA SPANDEX elastomer.

The elastomeric strands were elongated to 250% elongation and adhesively laminated between two layers of 0.4 osy polypropylene spunbond facing layers with a FINDLEY H2525A adhesive. The leg elastic members were stretched-to-stop, and adhesively laminated to the side marginal edges of the outer cover **30**. Accordingly, the laterally opposed pair of leg elastic members **36** created a gathered element at each leg opening of the diaper.

Six samples of all diapers were then subjected to the Product Deformation Test set forth above. The results of such test are set forth in Table 3 below.

TABLE 3

Diaper	Percent Permanent Leg Elastic Deformation
Example 3 - Hand made with Ex. 1 material	3.8%
Example 4 - Machine made with Ex. 1 material	17.3%
Example 5 - Hand made with Ex. 2 Material A	5.6%
Example 6 - Hand made with Ex. 2 Material B	6.2%
HUGGIES	0.5%
PAMPERS	1.4%

The results show that the diaper of Examples 3–6 exhibit greater leg elastic deformations than the conventional diapers. The combination of high elongation and high deformation or set of the diaper of Example 2 can provide a diaper that "gives" when cross directional forces are exerted on the diaper during fastening and wear. Thus, such a diaper can more readily conform and adjust to the changing body dimensions of the wearer as they move for improved fit and reduction in leakage. Moreover, the leg elastics on such a diaper can exhibit permanent lateral extension and enhanced curvature in use to provide greater coverage without requiring difficult manufacturing processes. Further, the outer cover on such a diaper also readily expand as the absorbent body in the diaper receives repeated insults and expands to provide more void volume in the diaper for improved containment.

One of the reasons that the Example 3 diaper of the present invention exhibited such high extensions and deformations compared to the tested commercial diapers when subjected to the Product Deformation Test set forth above is that it includes a bodyside liner material that is extensible. To illustrate such differences, the bodyside liner was removed from Example 3 diapers and PAMPERS Baby Dry diapers and subjected to the Material Elongation and Deformation Tensile Test set forth above. The results of such test are set forth in Table 4 below. The distance between the jaws of the tensile tester for each sample was 76.2 mm at an initial force of 1 gmf per inch of width.

TABLE 4

Material	Extented Length @ 100 gmf per inch (mm)	PostExtended Length @ 1 gmf per inch (mm)	Percent Elongation	Percent Permanent Deformation
Example 3 liner	121.1	102.8	58.9%	34.9%
PAMPERS liner	87.3	82.8	14.5%	8.6%

The results show that the bodyside liner from the diaper of Example 3 exhibits significantly greater elongations and

deformation than the bodyside liner removed from the conventional diapers that were tested. Using such an extensible bodyside liner allows the extensible outer cover to more freely extend and permanently deform. As discussed above, the combination of high elongation and high deformation or set of both the bodyside liner and the outer cover of the Example 3 diapers can provide a diaper that "gives" when cross directional forces are exerted on the diaper during fastening and wear for improved performance.

Examples 7–10

Examples of diapers of the present invention made according to Examples 3–6 above were tested and compared to Step 4 sized HUGGIES Ultratrim diapers commercially available from Kimberly-Clark Corporation to determine the longitudinal breathability gradient ratio. The PAMPERS Baby Dry diapers commercially available from The Procter and Gamble Company identified in Examples 3–6 were not included as their outer cover was not breathable in the intermediate or crotch section (i.e. exhibited a WVTR in the intermediate section of 0). Six samples of all diapers were subjected to the Product Deformation Test set forth above to determine the longitudinal breathability gradient ratio. The results of such test are set forth in Table 5 below.

TABLE 5

Diaper	Longitudinal Breathability Gradient
Example 7 - Hand made with Ex. 1 material	2.34
Example 8 - Machine made with Ex. 1 material	1.00
Example 9 - Hand made with Ex. 2 Material A	4.25
Example 10 - Hand made with Ex. 2 Material B	2.34
HUGGIES	0.95

The results show that the diaper of Examples 7, 9 and 10 exhibit greater longitudinal breathability gradient ratios and deformation than the conventional diapers. The combination of high elongation and high deformation or set of the diapers of the Examples can provide a diaper that has enhanced breathability in use that can lead to reduced skin hydration and improved skin health.

With regards to Example 8, it is believed that such material did not exhibit an increased longitudinal breathability gradient ratio since the composite outer cover was not extended a sufficient amount in the test to extend the film layer of the material enough to cause permanent set in the film and the resulting increase in breathability in the film.

Having described the invention in rather full detail, it will be readily apparent that various changes and modifications can be made without departing from the spirit of the invention. All of such changes and modifications are contemplated as being within the scope of the invention as defined by the subjoined claims.

We claim:

1. A disposable absorbent article which defines a front waist section, a rear waist section, an intermediate section which extends between and connects said waist sections, a pair of laterally opposed side edges, a pair of longitudinally opposed waist edges, a longitudinal direction and a lateral direction, said absorbent article comprising:

a) a substantially liquid-impermeable extensible outer cover;

b) a liquid permeable extensible bodyside liner; and

c) an absorbent body located between said extensible outer cover and said extensible bodyside liner;

wherein said extensible outer cover and said extensible bodyside liner are configured to provide a substantially permanent deformation of at least about 10 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to a Material Elongation and Deformation Tensile Test set forth herein.

2. The disposable absorbent article of claim 1 wherein said substantially permanent deformation of said extensible outer cover is at least about 15 percent.

3. The disposable absorbent article of claim 1 wherein said substantially permanent deformation of said extensible outer cover is at least about 17 percent.

4. The disposable absorbent article of claim 1 wherein said extensible outer cover is also configured to provide an elongation of at least about 20 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width.

5. The disposable absorbent article of claim 4 wherein said elongation of said extensible outer cover is at least about 30 percent.

6. The disposable absorbent article of claim 1 wherein said extensible bodyside liner is also configured to provide an elongation of at least about 20 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width.

7. The disposable absorbent article of claim 1 wherein said substantially permanent deformation of said extensible bodyside liner is at least about 20 percent.

8. The disposable absorbent article of claim 1 wherein said extensible outer cover and said extensible bodyside liner are configured to provide an elongation of at least about 20 percent and a substantially permanent deformation of at least about 10 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width according to said Material Elongation and Deformation Tensile Test set forth herein.

9. The disposable absorbent article of claim 1 wherein said extensible outer cover comprises a necked laminate which includes at least one layer of a non-elastic neckable material and at least one layer of a non-elastic film.

10. A disposable absorbent article which defines a front waist section, a rear waist section, an intermediate section which extends between and connects said waist sections, a pair of laterally opposed side edges, a pair of longitudinally opposed waist edges, a longitudinal direction and a lateral direction, said absorbent article comprising:

a) a substantially liquid-impermeable, extensible outer cover that defines a water vapor transmission rate of at least about 800 g/m^2/24 hr when subjected to a Mocon Water Vapor Transmission Test as set forth herein;

b) a liquid permeable extensible bodyside liner; and

c) an absorbent body located between said extensible outer cover and said extensible bodyside liner;

wherein said extensible outer cover and said extensible bodyside liner are configured to provide a substantially permanent deformation of at least about 10 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to a Material Elongation and Deformation Tensile Test set forth herein.

11. The disposable absorbent article of claim 10 wherein said substantially permanent deformation of said extensible outer cover and said extensible bodyside liner is at least about 20 percent.

12. The disposable absorbent article of claim 10 wherein said substantially permanent deformation of said extensible outer cover is at least about 17 percent.

13. The disposable absorbent article of claim 10 wherein said extensible outer cover is also configured to provide an

elongation of at least about 20 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width.

14. The disposable absorbent article of claim **13** wherein said elongation of said extensible outer cover is at least about 30 percent.

15. The disposable absorbent article of claim **10** wherein said extensible bodyside liner is also configured to provide an elongation of at least about 20 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width.

16. The disposable absorbent article of claim **15** wherein said elongation of said extensible bodyside liner is at least about 25 percent.

17. The disposable absorbent article of claim **10** wherein said water vapor transmission rate of said extensible outer cover is at least about 1200 $g/m^2/24$ hr.

18. The disposable absorbent article of claim **10** wherein said water vapor transmission rate of said extensible outer cover is at least about 2000 $g/m^2/24$ hr.

19. The disposable absorbent article of claim **10** wherein said extensible outer cover comprises a necked laminate which includes at least one layer of a non-elastic neckable material and at least one layer of a non-elastic film.

20. A pant-like, prefastened, disposable absorbent article which defines a front waist section, a rear waist section, an intermediate section which extends between and connects said waist sections, a pair of laterally opposed side edges, a pair of longitudinally opposed waist edges, a longitudinal direction and a lateral direction, said pant-like absorbent article comprising:

a) a substantially liquid-impermeable extensible outer cover;

b) a liquid permeable extensible bodyside liner;

c) an absorbent body located between said extensible outer cover and said extensible bodyside liner; and

d) a pair of fasteners refastenably attaching said laterally opposed side edges in said front waist section to said laterally opposed side edges in said rear waist section to provide said pant-like, prefastened absorbent article prior to packaging;

wherein said extensible outer cover and said extensible bodyside liner are configured to provide a substantially permanent deformation of at least about 10 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to a Material Elongation and Deformation Tensile Test set forth herein.

21. The pant-like, prefastened, disposable absorbent article of claim **20** wherein said substantially permanent deformation of said extensible outer cover and said extensible bodyside liner is at least about 20 percent.

22. The pant-like, prefastened, disposable absorbent article of claim **20** wherein said substantially permanent deformation of said extensible outer cover is at least about 17 percent.

23. The pant-like, prefastened, disposable absorbent article of claim **20** wherein said extensible outer cover is also configured to provide an elongation of at least about 20 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width.

24. The pant-like, prefastened, disposable absorbent article of claim **23** wherein said elongation of said extensible outer cover is at least about 30 percent.

25. The pant-like, prefastened, disposable absorbent article of claim **20** wherein said extensible bodyside liner is also configured to provide an elongation of at least about 20 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width.

26. The pant-like, prefastened, disposable absorbent article of claim **25** wherein said elongation of said extensible bodyside liner is at least about 25 percent.

27. The pant-like, prefastened, disposable absorbent article of claim **20** wherein said extensible outer cover and said extensible bodyside liner are configured to provide an elongation of at least about 20 percent and a substantially permanent deformation of at least about 10 percent when subjected to said tensile force of 100 gmf per inch (per 2.54 cm) of width according to said Material Elongation and Deformation Tensile Test set forth herein.

28. The pant-like, prefastened, disposable absorbent article of claim **20** wherein said extensible outer cover comprises a necked laminate which includes at least one layer of a non-elastic neckable material and at least one layer of a non-elastic film.

29. A disposable absorbent article which defines a front waist section, a rear waist section, an intermediate section which extends between and connects said waist sections, a pair of laterally opposed side edges, a pair of longitudinally opposed waist edges, a longitudinal direction and a lateral direction, said absorbent article comprising:

a) a substantially liquid-impermeable extensible outer cover, wherein the extensible outer cover is a necked laminate including at least one neckable nonwoven material;

b) a liquid permeable extensible bodyside liner, wherein the extensible bodyside liner includes a necked nonwoven material; and

c) an absorbent body located between said extensible outer cover and said extensible bodyside liner;

wherein said extensible outer cover and said extensible bodyside liner are configured to provide a substantially permanent deformation of at least about 10 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to a Material Elongation and Deformation Tensile Test set forth herein.

30. A disposable absorbent article which defines a front waist section, a rear waist section, an intermediate section which extends between and connects said waist sections, a pair of laterally opposed side edges, a pair of longitudinally opposed waist edges, a longitudinal direction and a lateral direction, said absorbent article comprising:

a) a substantially liquid-impermeable extensible outer cover, wherein the extensible outer cover is a laminate including at least one necked nonwoven material;

b) a liquid permeable extensible bodyside liner wherein the extensible bodyside liner includes a necked nonwoven material; and

c) an absorbent body located between said extensible outer cover and said extensible bodyside liner;

wherein said extensible outer cover and said extensible bodyside liner are configured to provide a substantially permanent deformation of at least about 10 percent when subjected to a tensile force of 100 gmf per inch (per 2.54 cm) of width according to a Material Elongation and Deformation Tensile Test set forth herein.

* * * * *

US006582413B2

(12) **United States Patent**
Krautkramer et al.

(10) **Patent No.: US 6,582,413 B2**
(45) **Date of Patent: Jun. 24, 2003**

(54) **ABSORBENT PRODUCT CONTAINING AN ELASTIC ABSORBENT COMPONENT**

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Related U.S. Application Data

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(51) **Int. Cl.**[7] **A61F 13/15**
(52) **U.S. Cl.** **604/385.16**; 604/385.22
(58) **Field of Search** 604/385.01, 385.16, 604/385.21, 385.22, 385.23

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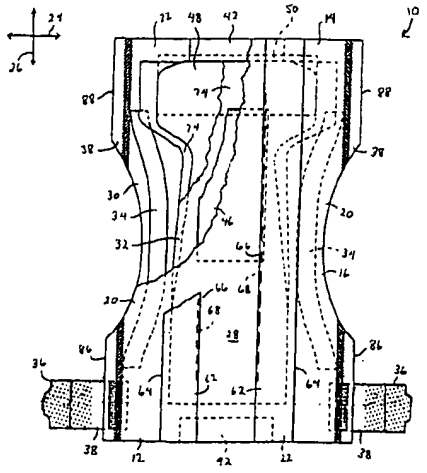
Primary Examiner—John G. Weiss
Assistant Examiner—Michael Bogart
(74) *Attorney, Agent, or Firm*—Paul Yee; Thomas M. Parker

(57) **ABSTRACT**

An absorbent article (**10**) has a longitudinal direction (**26**), a lateral, transverse direction (**24**), an article front portion (**14**), an article back portion (**12**), and an intermediate portion (**16**) interconnecting the front and back portions. The article includes an elastomerically stretchable backsheet member (**30**), a liquid-permeable topsheet layer (**28**), and an elastomerically stretchable retention portion (**48**) sandwiched between the backsheet member (**30**) and the topsheet layer (**28**). The topsheet layer can be elastomerically stretchable, and the absorbent article (**10**) can also provide a selected combination of physical properties, such as a composite-article elongation-at-peak-load value which is at least about 50 percent.

28 Claims, 8 Drawing Sheets



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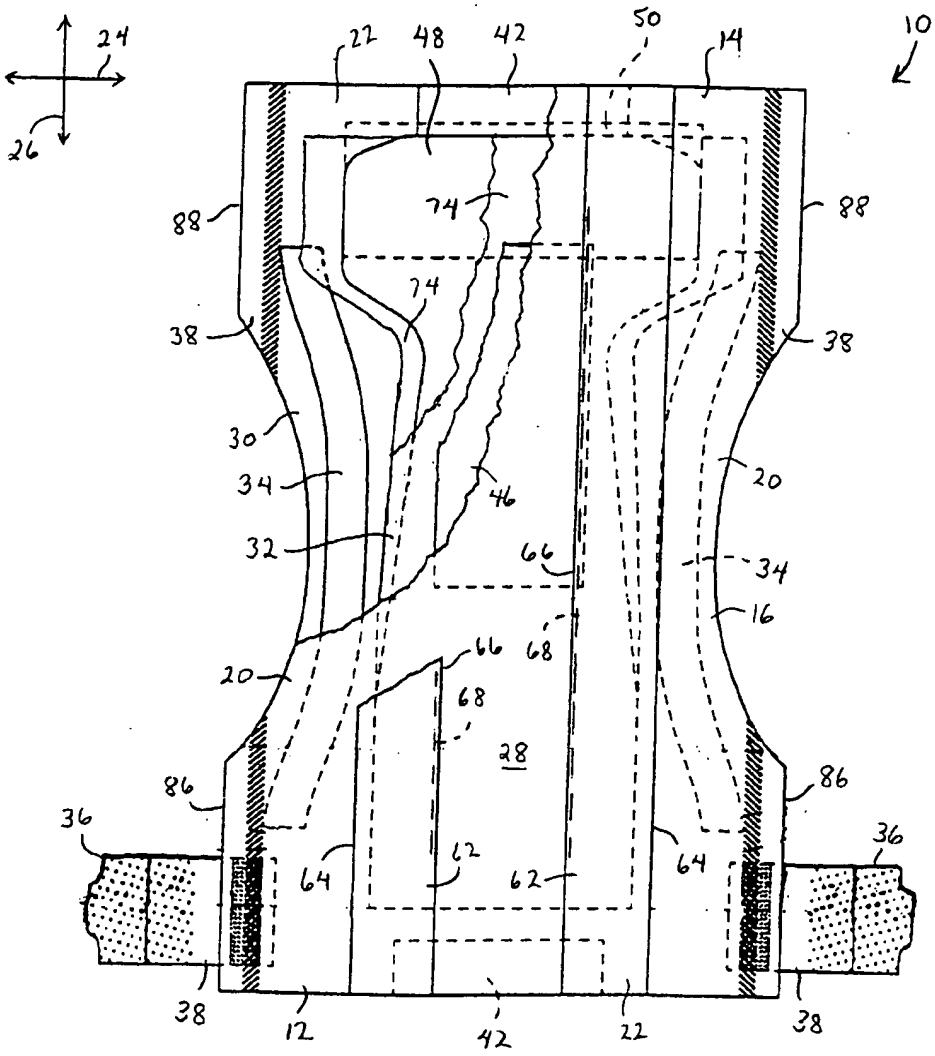
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Fig. 1

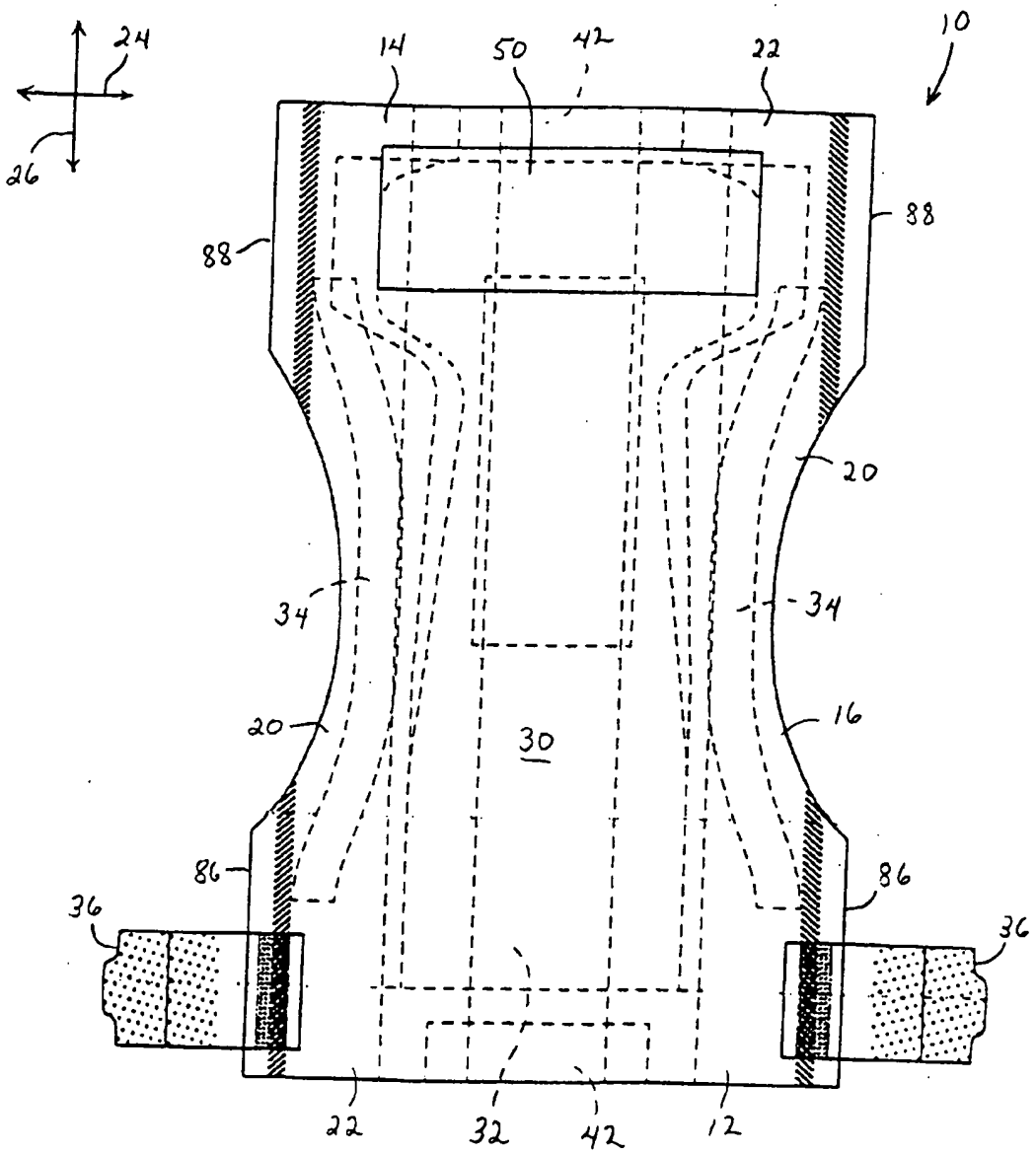

Fig. 2

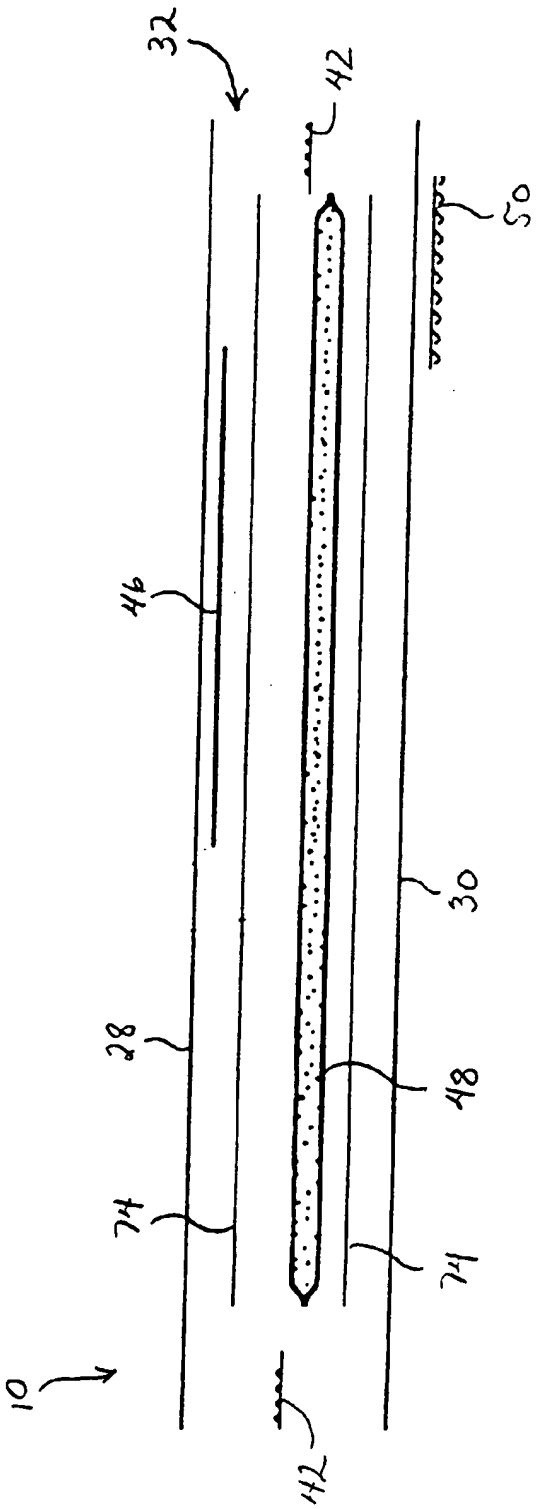

Fig. 3

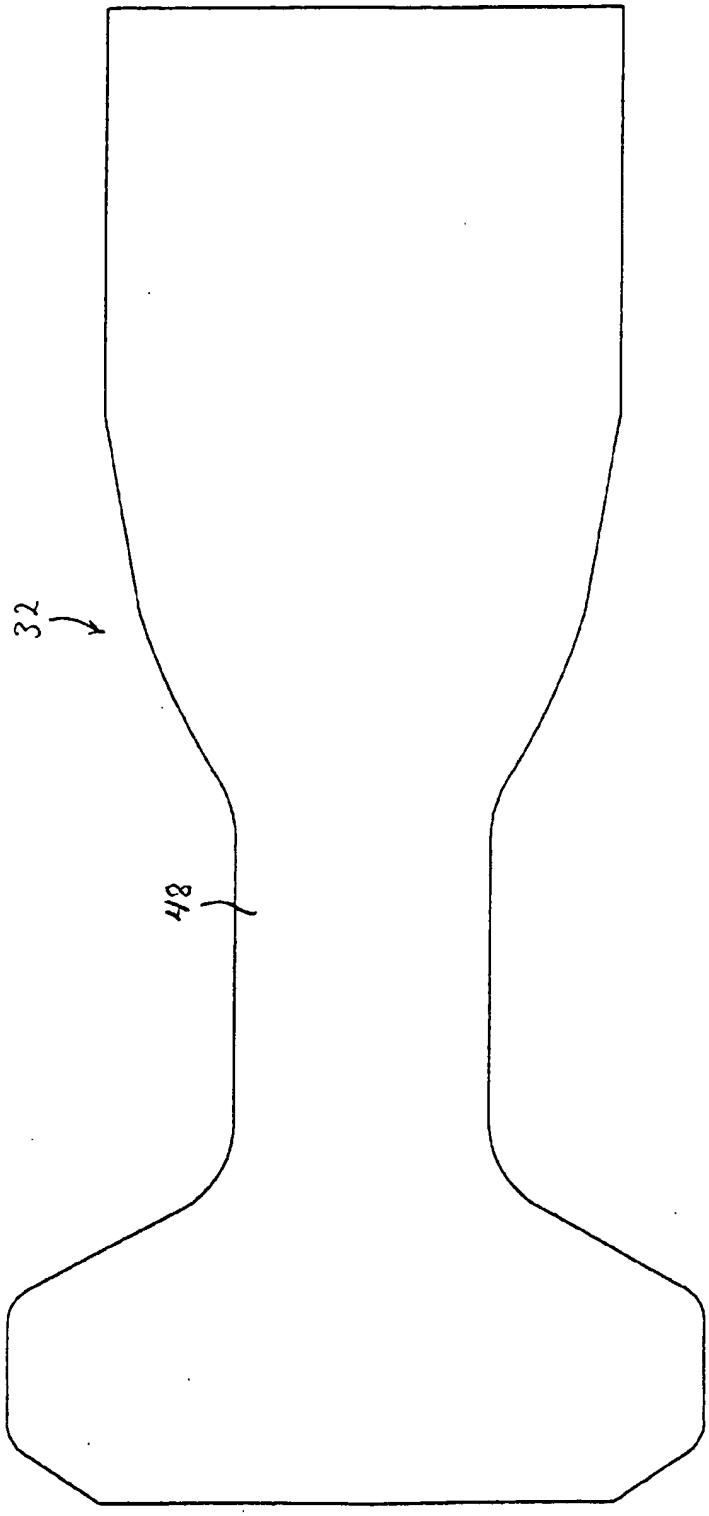

Fig. 4

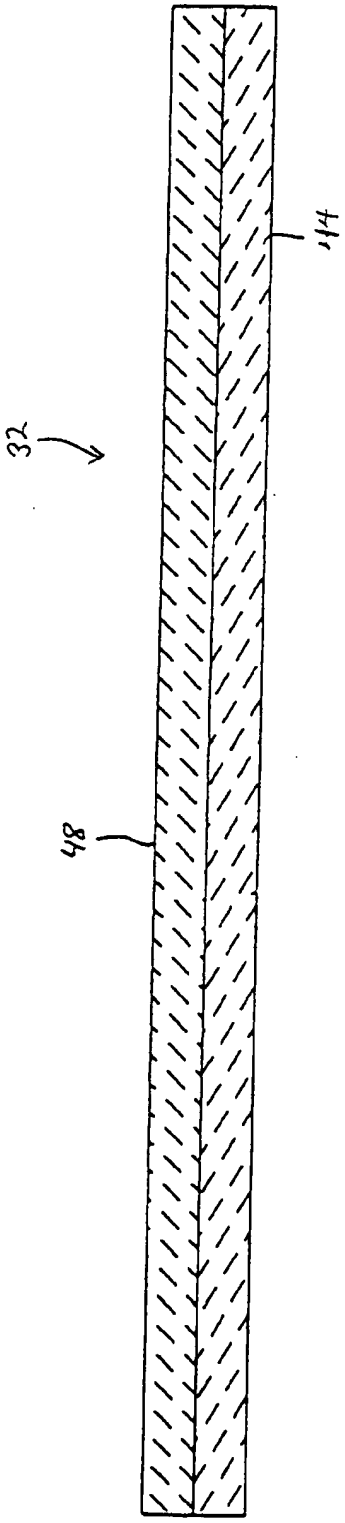

Fig. 4A

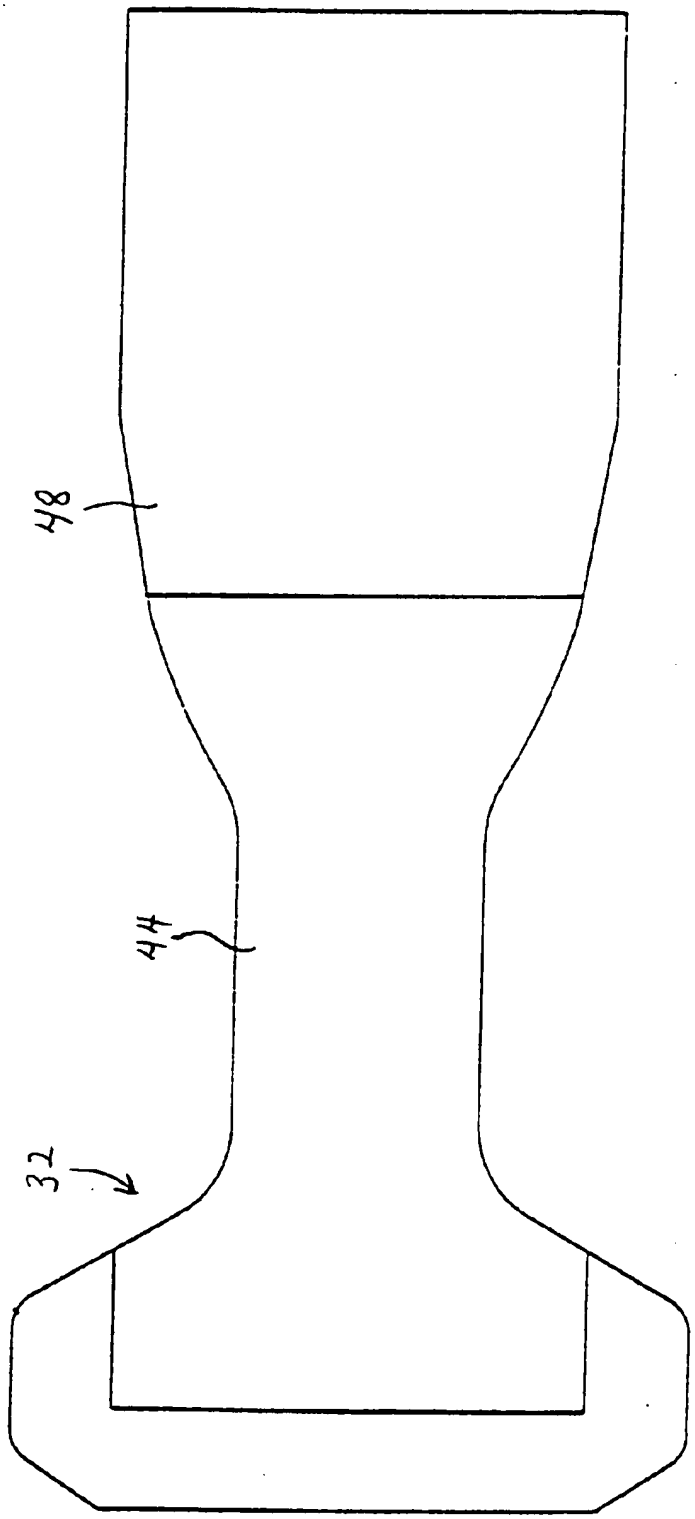

Fig. 5

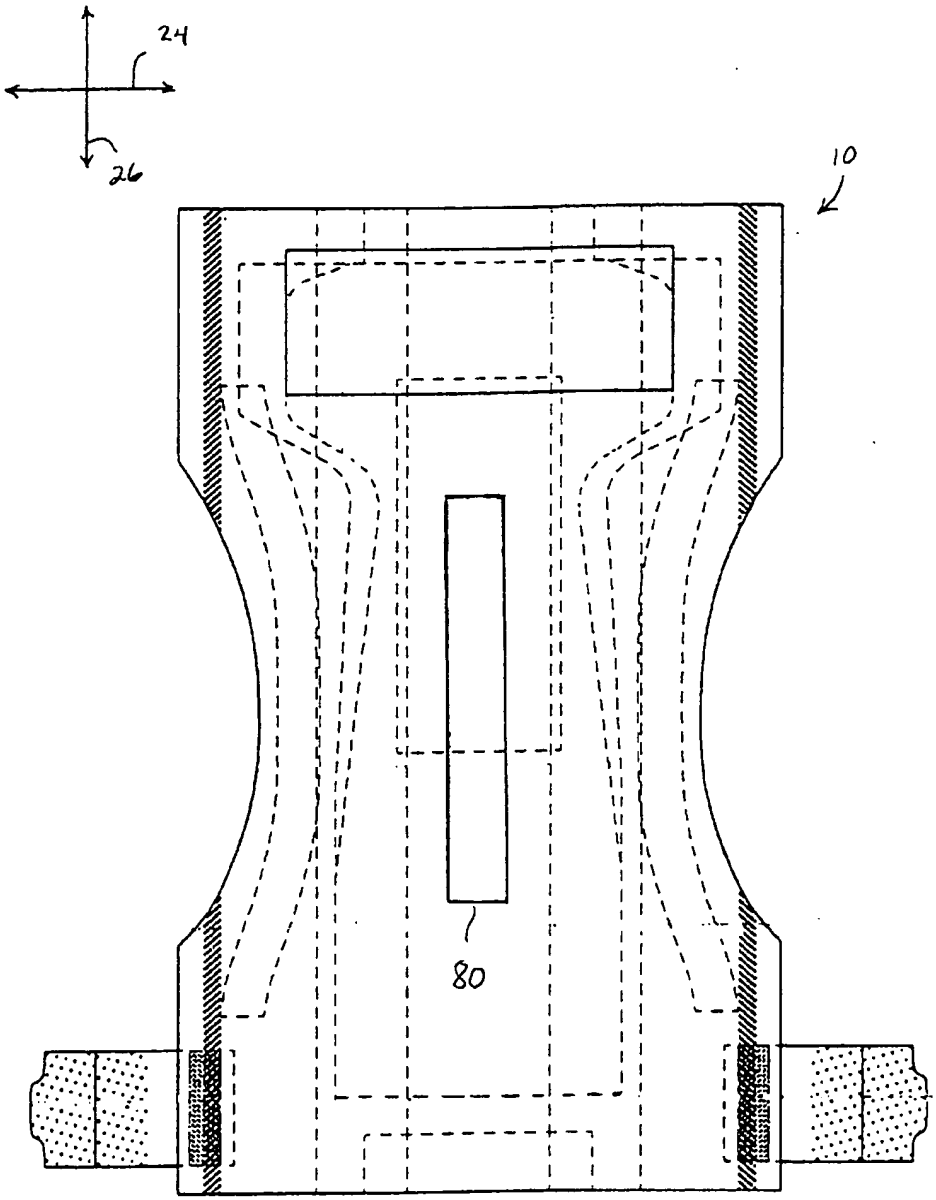

Fig. 6

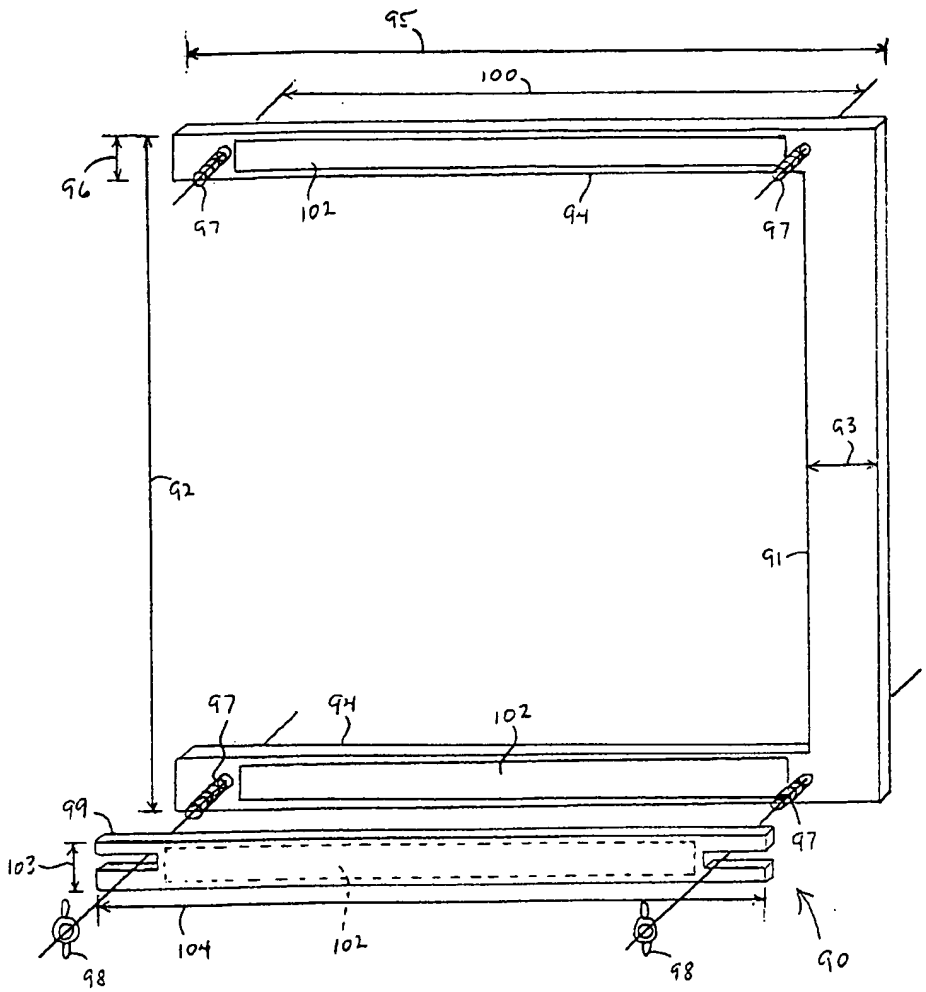

Fig. 7

ABSORBENT PRODUCT CONTAINING AN ELASTIC ABSORBENT COMPONENT

This application is a continuation of Ser. No. 09/387,950 filed Sep. 1, 1999 U.S. Pat. No. 6,231,557.

FIELD OF THE INVENTION

The present invention relates to absorbent articles. More particularly, the present invention relates to an absorbent article which includes an elastically stretchable absorbent structure. The absorbent article can exhibit improved levels of softness, fit and leakage resistance.

BACKGROUND OF THE INVENTION

The performance objectives of disposable absorbent articles, such as infant diapers, include leakage prevention, dry feel to the wearer, and a comfortable fit throughout the product life. Accordingly, absorbent articles have typically contained an absorbent core to provide liquid handling and other absorbent functionalities required to meet the product performance objectives. The absorbent core of a conventional absorbent article has typically been composed of absorbent fibers, and a superabsorbent material has typically been combined with the absorbent fibers to increase the liquid absorbent capacity. The absorbent core has been formed in a substantially rectangular shape. The absorbent core has also been formed in an hourglass shape, a T-shape, or similar configuration with a reduced absorbent width in the central crotch region for improved fit and comfort.

Conventional absorbent cores have incorporated dry-formed materials which have been produced with various conventional airlaying techniques. The airlaying techniques have typically laid an air-directed mixture of absorbent fibers and superabsorbent to form a web of the absorbent material.

Conventional absorbent cores have also incorporated wet-formed materials which have been produced with various wet-laying techniques. The wet-laying techniques have typically formed an absorbent web produced from a precursor material composed of a mixture of fibers and superabsorbent particles combined with water or other aqueous liquid. A particular wet-laying technique has processed the precursor material into a foam, and the foam has then been employed to form the desired web of absorbent material.

Such conventional absorbent cores have been elasticized by various techniques to provide elastomeric stretchability and better conformance to the wearer's body. In addition, the absorbent articles have incorporated elastomerically stretchable outercovers to provide better appearance and fit. Such elastomerically stretchable outercovers have included composites composed of nonwoven fabric webs and elastomeric webs. The elastomeric webs may be elastomeric films or elastomeric fabrics, and the entire outercover may be elastomerically stretchable.

Such conventional absorbent article, however, have not provided desired levels of stretchability, conformance and integrity. For example, the conventional absorbent articles have not provided a desired combination of relative stretchability between the outercover and the absorbent structure. The conventional absorbent articles also have not provided a desired combination of stress and strain characteristics between the outercover and the absorbent structure, and between the overall article and the absorbent structure. As a result, the conventional absorbent articles have exhibited unsightly appearance, poor fit and conformance, excessive gapping between the article and the wearer's body, and excessive leakage.

Consequently, there remains a need for absorbent structures which can provide desired combinations of flexibility, integrity, conformance to the wearer's body and improved leakage resistance.

BRIEF DESCRIPTION OF THE INVENTION

Generally stated, the present invention provides an absorbent article having a longitudinal direction, a lateral, transverse direction, a first portion, a second portion, and an intermediate portion interconnecting the first and second portions. The article includes a stretchable backsheet member, a liquid-permeable topsheet layer, and a stretchable retention portion sandwiched between the backsheet member and the topsheet layer. In particular aspects, the absorbent article can include a stretchable topsheet layer, and in other aspects, the article can provide a selected elongation-at-peak-load value. In still other aspects, the backsheet member, the retention portion and the article can have a selected combination of relative properties. In further aspects, the backsheet member can be substantially liquid-impermeable when stretched to a selected backsheet elongation.

The present invention can provide a distinctive absorbent article which can exhibit desirable physical properties, such as softness, flexibility, conformance, trim appearance, reduced gapping and reduced leakage during use. The article can also include an absorbent structure which exhibits desirable physical properties, such as improved softness, flexibility, durability, conformance and stretchability. As a result, the articles and absorbent structures of the invention can provide increased strength, improved fit, reduced leakage, and reduced clumping, bunching or sagging during use.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood and further advantages will become apparent when reference is made to the following detailed description of the invention and the drawings, in which:

FIG. **1** representatively shows a partially cut-away, top view of a diaper article which incorporates the fastening system of the invention;

FIG. **2** representatively shows a plan view of the outward side of the article representatively shown in FIG. **1**;

FIG. **3** representatively shows an expanded, schematic, longitudinal cross-sectional view of the article representatively shown in FIG. **1**;

FIG. **4** representatively shows a top, plan view of a multiple-layer absorbent retention portion which can be employed with the present invention;

FIG. **4A** representatively shows a longitudinal cross-section of the absorbent retention portion representatively shown in FIG. **4**;

FIG. **5** representatively shows a top, plan view of another absorbent retention portion which can be employed with the present invention, wherein the absorbent retention portion has multiple layers, with a first layer differently shaped and smaller than a second layer;

FIG. **6** representatively shows the location and orientation of a test specimen taken from a product article;

FIG. **7** shows a representative clamping frame employed to hold a test a specimen in a stretched, elongated condition.

DETAILED DESCRIPTION OF THE INVENTION

The various aspects and embodiments of the invention will be described in the context of a disposable absorbent

article, such as a disposable diaper. It is, however, readily apparent that the present invention could also be employed with other articles, such as gowns, covers, feminine care articles, children's training pants, incontinence garments and the like. Typically, the disposable articles are intended for limited use and are not intended to be laundered or otherwise cleaned for reuse. A disposable diaper, for example, is discarded after it has become soiled by the wearer.

It should also be noted that, when employed in the present disclosure, the terms "comprises", "comprising" and other derivatives from the root term "comprise" are intended to be open-ended terms that specify the presence of any stated features, elements, integers, steps, or components, but do not preclude the presence or addition of one or more other features, elements, integers, steps, components, or groups thereof. Accordingly, such terms are intended to be synonymous with the words "has", "have", "having", "includes", "including" and any derivatives of these words.

With reference to FIGS. **1**, **2** and **3**, an article, such as the representatively shown diaper **10**, has a lengthwise, longitudinal direction **26**, a lateral, transverse cross-direction **24**, a first article portion, such as a front portion **14**, a second article portion, such as a back portion **12**, and an intermediate portion **16** interconnecting the first and second portions. In particular configurations, the front and back portions may provide front and back waistband portions of the article. The article includes a substantially liquid-impermeable, stretchable backsheet member **30**, a liquid-permeable topsheet layer **28**, and a stretchable retention portion **48** sandwiched between the backsheet member **30** and the topsheet layer **28**. The backsheet member **30** and retention portion **48** are desirably elastomerically stretchable. The absorbent article can provide a selected elongation-at-peak-load value, such as an article elongation-at-peak-load value which is at least about **50** percent. Additionally, the backsheet member **30** can be substantially liquid-impermeable when stretched to a selected backsheet elongation, such as a backsheet elongation of at least about 45 percent. In particular aspects, the topsheet layer **28** is also stretchable, and desirably, is elastomerically stretchable.

In its various aspects, the invention can provide a distinctive absorbent article which can exhibit desirable physical properties, such as softness, flexibility, conformance, trim appearance, reduced gapping and reduced leakage. The article can include an absorbent structure, particularly a retention portion **48**, which exhibits desirable physical properties, such as improved softness, flexibility, durability, conformance and stretchability. As a result, the absorbent structures and articles of the invention can provide increased strength, improved fit, reduced leakage, and reduced clumping, bunching or sagging during use.

The article of the invention can, for example, be a garment provided by the representatively shown disposable diaper **10**. In desired aspects of the invention, the first article portion can, for example, provide a first, rear or back waistband portion **12**, and the second article portion can provide a second, front waistband portion **14**. In addition, the article can have an intermediate or crotch portion **16** which interconnects between the first and second waistband portions **12** and **14**, respectively. The diaper can further include a backsheet member **30**, a liquid permeable topsheet layer **28** connected and assembled in facing relation with the backsheet member, and an absorbent structure, such as a structure which includes an absorbent body **32**. The absorbent structure is sandwiched between the backsheet and topsheet layers, and is operably held therebetween.

In addition, a fastening system, such as the system including fasteners **36**, may be employed to interconnect the first waistband portion **12** with the second waistband portion **14** to hold the article on a wearer.

As representatively shown, the front waistband section **14** of the diaper **10** has a laterally opposed, front pair of side edge regions **88**, and the rear waistband section **12** has a laterally opposed, rear pair of side edge regions **86**. The intermediate section **16** interconnects the front and rear waistband section and provides a diaper crotch region which is typically positioned between the legs of the wearer. The article has an appointed fastener landing zone member **50** which is disposed on the outward surface of the article. In the configuration shown in FIGS. **1**, **2** and **3**, for example, the landing member **50** is disposed on the outward surface of the backsheet member **30**. The liquid permeable topsheet layer **28** is superposed in facing relation with the backsheet member **30**, and the absorbent body **32** is operably connected and affixed between the backsheet member **30** and topsheet layer **28**.

FIGS. **1** and **2** show typical plan views of the representative disposable diaper **10** in its generally flat-out, uncontracted state (i.e., with substantially all elastic induced gathering and contraction removed). In FIG. **1**, the bodyside surface of the diaper which contacts the wearer is facing the viewer, and portions of the structure are partially cut away to more clearly show the interior construction of the diaper article. The outer edges of the diaper define a periphery with longitudinally extending side edge margins **20** and laterally extending end edge margins **22**. The side edges define leg openings for the diaper, and optionally, are curvilinear and contoured. The end edges are shown as straight, but optionally, may be curvilinear.

With regard to the designated surfaces of the article, the various inward or bodyside surfaces are configured to face toward the body of the wearer when the article is placed about the wearer. The designated outward surfaces of the article is configured to face away from the wearer's body when the article is placed about the wearer.

The diaper **10** can typically include a porous, liquid permeable topsheet **28**; a substantially liquid impermeable backsheet **30**; an absorbent body structure **32** positioned and connected between the topsheet and backsheet; a surge management portion **46** located adjacent the absorbent structure; and a system of elastomeric gathering members, such as a system including leg elastics **34** and waist elastics **42** The surge management portion is positioned in a liquid communication with an appointed storage or retention portion **48** of the absorbent structure, and the topsheet **28**, backsheet **30**, absorbent structure **32**, surge management portion **46** and elastic members **34** and **42** may be assembled together into a variety of well-known diaper configurations. The diaper can additionally include a system of containment flaps **62**, and a system of side panel or ear region members **38**, which may be elasticized or otherwise rendered elastomeric.

Examples of articles which include elasticized side panels and selectively configured fastener tabs are described in U.S. patent application Ser. No. 168,615 of T. Roessler et al., entitled DYNAMIC FITTING DIAPER, and filed Dec. 6, 1993. Various techniques for forming the desired fastening systems are described in U.S. Pat. No. 5,399,219 of T. Roessler et al., entitled METHOD FOR MAKING A FASTENING SYSTEM FOR A DYNAMIC FITTING DIAPER which issued Mar. 21, 1995; in U.S. patent application Ser. No. 286,086 of D. Fries, entitled A PROCESS FOR

ASSEMBLING ELASTICIZED EAR PORTIONS and filed Aug. 3, 1994 which corresponds to U.S. Pat. No. 5,540,796; and in U.S. patent application Ser. No. 08/415,383 of D. Fries, entitled AN ASSEMBLY PROCESS FOR A LAMINATED TAPE and filed Apr. 3, 1995 which corresponds to U.S. Pat. No. 5,595,618. The disclosures of the above-described documents are incorporated herein by reference in a manner that is consistent (not in conflict) herewith.

The diaper **10** generally defines the longitudinally extending length direction **26** and the laterally extending width direction **24**, as representatively shown in FIGS. **1** and **2**. The diaper may have any desired shape, such as rectangular, I-shaped, a generally hourglass shape, or a T-shape. With the T-shape, the crossbar of the "T" may comprise the front waistband portion of the diaper, or may alternatively comprise the rear waistband portion of the diaper.

The topsheet **28** and backsheet **30** may be generally coextensive, and may have length and width dimensions which are generally larger than and extend beyond the corresponding dimensions of the absorbent structure **32** to provide for the corresponding side margins **20** and end margins **22**. Optionally, the topsheet layer and backsheet member may not be coextensive. The topsheet **28** is operatively associated with and superimposed on backsheet **30**, thereby defining the periphery of the diaper. The waistband regions comprise those portions of the diaper, which when worn, wholly or partially cover or encircle the waist or mid-lower torso of the wearer. The intermediate, crotch region **16** lies between and interconnects the waistband regions **14** and **12**, and comprises that portion of the diaper which, when worn, is positioned between the legs of the wearer and covers the lower torso of the wearer. Thus, the intermediate crotch region **16** is an area where repeated fluid surges typically occur in the diaper or other disposable absorbent article.

The backsheet **30** can typically be located along an outer-side surface of the absorbent body **32** and may be composed of a liquid permeable material, but desirably comprises a material which is configured to be substantially impermeable to liquids. For example, a typical backsheet can be manufactured from a thin plastic film, a composite laminate, or other flexible, substantially liquid-impermeable material. As used in the present specification, the term "flexible" refers to materials which are compliant and which will readily conform to the general shape and contours of the wearer's body. The backsheet **30** substantially prevents the exudates contained in absorbent body **32** from wetting articles, such as bedsheets and overgarments, which contact the diaper **10**. In particular embodiments of the invention, the backsheet **30** can include a 0.4 osy (13.6 g/m^2) basis weight of G2760 KRATON elastomer strands adhesively laminated with a 0.3 g/m^2 add-on of adhesive between two facings. Each facing can be composed of a thermal point bonded bicomponent spunbond nonwoven fibrous web having a 0.7 osy (23.7 g/m2) basis weight. The adhesive is similar to an adhesive which is supplied by AtoFindley Adhesive and designated as H2525 A, and the elastomer strands are placed and distributed to provide approximately 12 strands of KRATON elastomer per inch (2.54 cm) of lateral width of the backsheet material.

Alternative constructions of the backsheet member may comprise a woven or non-woven fibrous web layer which has been totally or partially constructed or treated to impart the desired levels of liquid impermeability to selected regions that are adjacent or proximate the absorbent body. For example, the backsheet may include a gas-permeable, nonwoven fabric layer laminated to a polymer film layer which may or may not be gas-permeable. Other examples of fibrous, cloth-like backsheet materials can comprise a stretch thinned or stretch thermal laminate material composed of a 0.6 mil (0.015 mm) thick polypropylene blown film and a 0.7 ounce per square yard (23.8 g/m^2) polypropylene spunbond material (2 denier fibers). A material of this type forms the outercover of a HUGGIES SUPREME disposable diaper, which is commercially available from Kimberly-Clark Corporation. The backsheet **30** typically provides the outer cover of the article. Optionally, however, the article may include a separate outer cover component member which is additional to the backsheet.

The backsheet **30** may alternatively include a microporous, "breathable" material which permits gases, such as water vapor, to escape from the absorbent body **32** while substantially preventing liquid exudates from passing through the backsheet. For example, the breathable backsheet may be composed of a microporous polymer film or a nonwoven fabric which has been coated or otherwise modified to impart a desired level of liquid impermeability. For example, a suitable microporous film can be a PMP-1 material, which is available from Mitsui Toatsu Chemicals, Inc., a company having offices in Tokyo, Japan; or an XKO-8044 polyolefin film available from 3M Company of Minneapolis, Minn. The backsheet may also be embossed or otherwise provided with a pattern or matte finish to exhibit a more aesthetically pleasing appearance. in the various configurations of the invention, where a component such as the backsheet **30** or the containment flaps **62** are configured to be permeable to gas while having a resistance and limited permeability to aqueous liquid, the liquid resistant or substantially liquid-impermeable material can have a construction which is capable of supporting a selected hydrohead of at least about 45 cm of water substantially without leakage therethrough. A suitable technique for determining the resistance of a material to liquid penetration and the capability of the material to support a hydrohead of water without substantial leakage is Federal Test Method Standard FTMS 191 Method 5514, 1978, or an equivalent thereof.

The size of the backsheet **30** is typically determined by the size of absorbent body **32** and the particular diaper design selected. Backsheet **30**, for example, may have a generally T-shape, a generally I-shape or a modified hourglass shape, and may extend beyond the terminal edges of absorbent body **32** by a selected distance, such as a distance within the range of about 1.3 centimeters to 2.5 centimeters (about 0.5 to 1 inch), to provide at least a portion of the side and end margins.

Desirably, the backsheet member **30** is substantially elastomerically stretchable. The backsheet member may, for example, be composed of a single layer, multiple layers, laminates, spunbond fabrics, films, meltblown fabrics, elastic netting, microporous web, bonded carded webs or foams comprised of elastomeric or polymeric materials. Elastomeric nonwoven laminate webs may include a nonwoven material joined to one or more gatherable nonwoven webs, films, or foams. Stretch Bonded Laminates (SBL) and Neck Bonded Laminates (NBL) are examples of elastomeric composites. Nonwoven fabrics are any web of material which has been formed without the use of textile weaving processes which produce a structure of individual fibers which are interwoven in an identifiable repeating manner. Examples of suitable materials are Spunbond-Meltblown fabrics, Spunbond-Meltblown-Spunbond fabrics, Spunbond fabrics, or laminates of such fabrics with films, foams, or other nonwoven webs. Elastomeric materials may include cast or blown films, foams, or meltblown fabrics composed

of polyethylene, polypropylene, or polyolefin copolymers, as well as combinations thereof. The elastomeric materials may include PEBAX elastomer (available from AtoChem located in Philadelphia, Pa.), HYTREL elastomeric polyester (available from E. I. DuPont de Nemous located in Wilmington, Del.), KRATON elastomer (available from Shell Chemical Company located in Houston, Tex.), or strands of LYCRA elastomer (available from E. I. DuPont de Nemous located in Wilmington, Del.), or the like, as well as combinations thereof. These backsheet member **30** may include materials that have elastomer properties through a mechanical process, printing process, heating process, or chemical treatment. For examples such materials may be apertured, creped, neck-stretched, heat activated, embossed, and micro-strained; and may be in the form of films, webs, and laminates.

In desired arrangements, the backsheet member **30** can have a selected resistance to liquid penetration when stretched to an elongation of 45%. In particular aspects, the backsheet member can have a construction which is capable of supporting a hydrohead of at least about 10 cm of water substantially without leakage therethrough. The backsheet member can alternatively support a hydrohead of at least about 14 cm, and optionally, can support a hydrohead of at least about 20 cm to provide improved performance.

In further aspects of the invention, the backsheet member **30** can be substantially liquid-impermeable and support a hydrohead of at least about 45 cm when stretched to a backsheet elongation which is at least a minimum of about 45%. Alternatively, the backsheet can be substantially liquid-impermeable when stretched to a backsheet elongation which is at least about 47%, and optionally, is at least about 50% to provide improve performance. In other aspects, the backsheet can be substantially liquid-impermeable when stretched to a backsheet elongation of up to about 60%. The backsheet can be substantially liquid-impermeable when stretched to a backsheet elongation which is alternatively up to about 75%, and optionally, is up to about 100%, or more, to provide improved performance.

A suitable technique for determining the resistance of a material to liquid penetration and the capability of the material to support a hydrohead of water without substantial leakage can incorporate Federal Test Method Standard FTMS 191 Method 5514, 1978, or an equivalent thereof, as described in the Modified Hydrohead For Stretched Materials Testing section of the Procedures portion of the present disclosure.

In other aspects, the backsheet member **30** can have a backsheet elongation-at-peak-load value which is at least a minimum of about 45%, and desirably, is at least about 50%. The backsheet elongation-at-peak-load value can alternatively be at least about 55%, and optionally, can be at least about 75% to provide improved performance. Further configurations of the backsheet member can provide a backsheet elongation-at-peak-load value of at least about 100% to further improve performance. In other aspects, the backsheet elongation-at-peak-load value can be up to a maximum of about 400%, or more. The backsheet elongation-at-peak-load value can alternatively be up to about 300%, and optionally, can be up to about 200%, to provide improved benefits.

The topsheet **28** presents a body-facing surface which is compliant, soft-feeling, and non-irritating to the wearer's skin. Further, the topsheet **28** can be less hydrophilic than absorbent body **32**, and is sufficiently porous to be liquid permeable, permitting liquid to readily penetrate through its thickness to reach the absorbent body. A suitable topsheet layer **28** may be manufactured from a wide selection of web materials, such as porous foams, reticulated foams, apertured plastic films, natural fibers (for example, wood or cotton fibers), synthetic fibers (for example, polyester or polypropylene fibers), or a combination of natural and synthetic fibers. The topsheet layer **28** is typically employed to help isolate the wearer's skin from liquids held in absorbent body **32**.

Various woven and nonwoven fabrics can be used for topsheet **28**. For example, the topsheet may include a meltblown web, a spunbonded web, or a bonded-carded-web composed of the desired fibers. The various fabrics can be composed of natural fibers, synthetic fibers or combinations thereof.

For the purposes of the present disclosure, the term "nonwoven web" means a web of fibrous material which is formed without the aid of a textile weaving or knitting process. The term "fabrics" is used to refer to all of the woven, knitted and nonwoven fibrous webs.

The topsheet fabrics may be composed of a substantially hydrophobic material, and the hydrophobic material may optionally be treated with a surfactant or otherwise processed to impart a desired level of wettability and hydrophilicity. In a particular embodiment of the invention, the topsheet **28** can be a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web having a basis weight of about 12 g/m^2 which is necked approximately 60%. Strands of about 9 g/m^2 KRATON G2760 elastomer material placed eight strands per inch (2.54 cm) are adhered to the necked spunbond material. The fabric can be surface treated with an operative amount of surfactant, such as about 0.6% AHCOVEL Base N62 surfactant, available from ICI Americas, a business having offices located in Wilmington, Del. The surfactant can be applied by any conventional means, such as spraying, printing, brush coating or the like.

In particular aspects, the bodyside liner or topsheet layer may be comprised of polymer fibers, networks, laminates, liquid permeable films, cellulosic fibers, rayon, water swellable gels, and elastomeric materials, as well as combinations thereof. Suitable materials for the topsheet layer can include meltblown webs, airlaid webs, spunbond webs, or bonded-carded webs of synthetic continuous or discrete polymer fibers and/or natural fibers, a pattern bonded spunbonded web, airlaid web, or bonded carded web, as well as combinations thereof. Suitable polymers can include polypropylene, polyethylene, polyester, and bicomponent materials composed of these polyolefins. Suitable elastomeric materials can include elastic strands, LYCRA elastics, elastic films, cast or blown; nonwoven elastic webs, meltblown or spunbond elastomeric fibrous webs, as well as combinations thereof. Examples of elastomeric materials include KRATON elastomers, HYTREL elastomers, ESTANE elastomeric polyurethanes (available from B.F. Goodrich and Company located in Cleveland, Ohio), or PEBAX elastomers. The topsheet layer may include blends or laminates of fibers, scrim, webs, and films with perforations, apertures, creping, heat activation, embossing, micro-straining, chemically treatment, or the like, as well as combinations thereof.

In desired aspects, the topsheet layer **28** can provide a topsheet elongation-at-peak-load value which is at least a minimum of about 45%, and desirably, is at least about 50%. The topsheet elongation-at-peak-load value can alternatively be at least about 55%, and optionally, can be at least about

75% to provide improved performance. Further configurations of the topsheet layer can provide a topsheet elongation-at-peak-load value of at least about 100% to further improve performance. In other aspects, the topsheet layer **28** can provide a topsheet elongation-at-peak-load value which is not more than a maximum of about 300%. The topsheet elongation-at-peak-load value can alternatively be not more about 250%, and optionally, can be not more than about 200% about to provide desired benefits.

The topsheet **28** and backsheet **30** are connected or otherwise associated together in an operable manner. As used herein, the term "associated" encompasses configurations in which topsheet **28** is directly joined to backsheet **30** by affixing topsheet **28** directly to backsheet **30**, and configurations wherein topsheet **28** is indirectly joined to backsheet **30** by affixing topsheet **28** to intermediate members which in turn are affixed to backsheet **30**. Topsheet **28** and backsheet **30** can, for example, be joined to each other in at least a portion of the diaper periphery by suitable attachment mechanisms (not shown) such as adhesive bonds, sonic bonds, thermal bonds, pinning, stitching or any other attachment technique known in the art, as well as combinations thereof. For example, a uniform continuous layer of adhesive, a patterned layer of adhesive, a sprayed pattern of adhesive or an array of separate lines, swirls or spots of construction adhesive may be used to affix the topsheet **28** to the backsheet **30**. It should be readily appreciated that the above-described attachment means may also be employed to suitably interconnect, assemble and/or affix together the various other component parts of the articles which are described herein.

The absorbent body **32** provides an absorbent structure which can include a retention portion **48**, such as the shown absorbent pad composed of selected hydrophilic fibers and high-absorbency particles, which holds and stores absorbed liquids and other waste materials. The absorbent body is positioned and sandwiched between the topsheet **28** and backsheet **30** to form the diaper **10**. The absorbent body has a construction which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining body exudates. It should be understood that, for purposes of this invention, the absorbent body structure may comprise a single, integral piece of material, or alternatively, may comprise a plurality of individual separate pieces of material which are operably assembled together.

Various types of wettable, hydrophilic fibrous material can be used to form the component parts of absorbent body **32**. Examples of suitable fibers include naturally occurring organic fibers composed of intrinsically wettable material, such as cellulosic fibers; synthetic fibers composed of cellulose or cellulose derivatives, such as rayon fibers; inorganic fibers composed of an inherently wettable material, such as glass fibers; synthetic fibers made from inherently wettable thermoplastic polymers, such as particular polyester or polyamide fibers; and synthetic fibers composed of a nonwettable thermoplastic polymer, such as polypropylene fibers, which have been hydrophilized by appropriate means. The fibers may be hydrophilized, for example, by treatment with silica, treatment with a material which has a suitable hydrophilic moiety and is not readily removable from the fiber, or by sheathing the nonwettable, hydrophobic fiber with a hydrophilic polymer during or after the formation of the fiber. For the purposes of the present invention, it is contemplated that selected blends of the various types of fibers mentioned above may also be employed.

As used herein, the term "hydrophilic" describes fibers or the surfaces of fibers which are wetted by the aqueous liquids in contact with the fibers. The degree of wetting of the materials can, in turn, be described in terms of the contact angles and the surface tensions of the liquids and materials involved. Equipment and techniques suitable for measuring the wettability of particular fiber materials or blends of fiber materials can be provided by a Cahn SFA-222 Surface Force Analyzer System, or a substantially equivalent system. When measured with such system, fibers having contact angles less than 90° are designated "wettable", while fibers having contact angles greater than 90° are designated "nonwettable".

The absorbent body structure **32** can comprise a matrix, such as a matrix of hydrophilic fibers, combined with particles of high-absorbency material, such as superabsorbent polymer material. The absorbent body may, for example, include a matrix web of cellulosic fluff. In particular arrangements, the absorbent body **32** may comprise a mixture of superabsorbent hydrogel-forming particles and synthetic polymer meltblown fibers, or a mixture of superabsorbent particles with a fibrous coform material comprising a blend of natural fibers and/or synthetic polymer fibers. The superabsorbent particles may be substantially homogeneously mixed with the hydrophilic fibers, or may be non-uniformly mixed.: For example, the concentrations of superabsorbent particles may be arranged in a non-step-wise gradient through a substantial portion of the thickness (z-direction) of the absorbent structure, with lower concentrations toward the bodyside of the absorbent body and relatively higher concentrations toward the outerside of the absorbent structure. Suitable z-gradient configurations are described in U.S. Pat. No. 4,699,823 issued Oct. 13, 1987 to Kellenberger et al., the entire disclosure of which is incorporated herein by reference in a manner that is consistent (not in conflict) with the present disclosure. Alternatively, the concentrations of superabsorbent particles may be arranged in a non-step-wise gradient, through a substantial portion of the thickness (z-direction) of the absorbent structure, with higher concentrations toward the bodyside of the absorbent body and relatively lower concentrations toward the outerside of the absorbent structure. The superabsorbent particles may also be arranged in a generally discrete layer within the matrix of hydrophilic fibers. In addition, two or more different types of superabsorbent may be selectively positioned at different locations within or along the fiber matrix.

The high-absorbency material may include absorbent gelling materials, such as superabsorbents. The absorbent gelling materials can be natural, synthetic and modified natural polymers and materials. In addition, the absorbent gelling materials can be inorganic materials, such as silica gels, or organic compounds such as cross-linked polymers. The term "cross-linked" refers to any means for effectively rendering normally water-soluble materials substantially water insoluble but swellable. Such means can include, for example, physical entanglement, crystalline domains, covalent bonds, ionic complexes and associations, hydrophilic associations, such as hydrogen bonding, and hydrophobic associations or Van der Waals forces.

Examples of synthetic absorbent gelling material polymers include the alkali metal and ammonium salts of poly (acrylic acid) and poly (methacrylic acid), poly (acrylamides), poly(vinyl ethers aleic anhydride copolymers with vinyl ethers and alpha-olefins, poly(vinyl pyrrolidone), poly(vinylmorpholinone), poly(vinyl alcohol), and mixtures and copolymers thereof. Further polymers suitable for use in the absorbent body include natural and modified natural polymers, such as hydrolyzed acrylonitrile-grafted starch,

acrylic acid grafted starch, methyl cellulose, chitosan, carboxymethyl cellulose, hydroxypropyl cellulose, and the natural gums, such as alginates, xanthan gum, locust bean gum and the like. Mixtures of natural and wholly or partially synthetic absorbent polymers can also be useful in the present invention. Other suitable absorbent gelling materials are disclosed by Assarsson et al. in U.S. Pat. No. 3,901,236 issued Aug. 26, 1975. Processes for preparing synthetic absorbent gelling polymers are disclosed in U.S. Pat. No. 4,076,663 issued Feb. 28, 1978 to Masuda et al. and U.S. Pat. No. 4,286,082 issued Aug. 25, 1981 to Tsubakimoto et al.

Synthetic absorbent gelling materials typically are xerogels which form hydrogels when wetted. The term "hydrogel", however, has commonly been used to also refer to both the wetted and unwetted forms of the synthetic polymer material.

The high-absorbency or superabsorbent materials can be in many forms such as flakes, powders, particulates, fibers, continuous fibers, networks, solution spun filaments and webs. In the representatively shown arrangement, the high-absorbency material in the absorbent body **32** is generally in the form of discrete particles. The particles can be of any desired shape, for example, spiral or semi-spiral, cubic, rod-like, polyhedral, etc. Shapes having a large greatest dimension/smallest dimension ratio, like needles, flakes, and fibers, are also contemplated for use herein. Conglomerates of particles of absorbent gelling material may also be used in absorbent body **32**. Desired for use are particles having an average size of from about 20 microns to about 1 millimeter. "Particle size" as used herein means the weighted average of the smallest dimension of the individual particles.

The hydrophilic fibers and high-absorbency particles can be configured to form an average composite basis weight which is within the range of about 100–1200 g/m^2. In certain aspects of the invention, the average composite basis weight can be within the range of about 500–1100 g/m^2, and alternatively can be within the range of about 600–1000 g/m^2 to provide desired performance.

In its various aspects and configurations, the absorbent structure of the invention can exhibit desirable physical properties, such as desired combinations of softness, flexibility and elasticity. Since the absorbent article of the invention can better conform to the body of the wearer, it can reduce gapping at the leg and waist thereby improving the efficiency of the absorbent article to contain and absorb body discharges without leaking. As a result, the absorbent structures and articles of the invention can provide improved fit, reduced leakage, and improved appearance.

As previously described, the absorbent structure of the retention portion **48** can include a selected combination of fibrous material and superabsorbent material. The fibrous material may include absorbent fibers, substantially nonabsorbent fibers, wettable fibers, substantially nonwettable fibers, cellulosic fibers, non-cellulosic fibers, natural fibers, or synthetic fibers, as well as combinations thereof. In particular aspects of the invention the structure of the retention portion **48** can include at least a minimum of about 0.5 wt % superabsorbent material, as determined with respect to the total weight of the dry retention portion. In selected products, such as articles configured for feminine care and light incontinence, the retention portion can alternatively include at least about 0.7 wt % superabsorbent material, and optionally, can include at least about 1 wt % superabsorbent material to provide improved benefits. In other selected products, such as articles configured for infant care diapers and child care training pants, the retention portion can include at least about 15 wt % superabsorbent material, and optionally, can include at least about 30 wt % superabsorbent material to provide improved performance.

In other aspects of the invention, the absorbent structure of the retention portion **48** can include not more than a maximum of about 80 wt % superabsorbent material, as determined with respect to the total weight of the wet-formed material in the dry retention portion **48**. In selected products, such as articles configured for feminine care and light incontinence, the retention portion can include not more than about 15 wt % superabsorbent material, and alternatively, can include not more than about 10 wt % superabsorbent material to provide improved benefits. Optionally, the retention portion of such products can include not more than about 5 wt % superabsorbent material to provide desired benefits. In other selected products, such as articles configured for infant care diapers and child care training pants, the retention portion can include not more than about 70 wt % superabsorbent material, and optionally, can include not more than about 60 wt % superabsorbent material to provide improved performance.

With reference to FIG. **3**, the retention portion **48** can have a selected incremental absorbent capacity, a selected total absorbent capacity, a selected amount of superabsorbent material, a selected amount of elastomeric fibers, and a selected amount of absorbent fibers.

Particular aspects of the invention can include a retention portion **48** having an incremental absorbent capacity of at least about 5 grams of absorbed liquid per gram of absorbent (5 g/g). The incremental absorbent capacity can alternatively be at least about 8 g/g, and can optionally be at least about 10 g/g to provide improved performance. In addition, the incremental absorbent capacity can be not more than about 50 g/g. Alternatively, the incremental absorbent capacity can be not more than about 40 g/g, and optionally, can be not more than about 35 g/g to provide improved benefits. These values are important because they can provide the product with an advantageous combination of high absorbent capacity and good comfort and fit throughout the product life cycle. Values below the low end of the capacity range can cause the product to leak prematurely due to insufficient capacity. Values greater than the high end of the capacity range can cause the product to sag or gap during use due to an excessive weight of absorbed liquid.

In other aspects of the invention, a total absorbent capacity of the retention portion can be at least a minimum of about 20 grams (20 g) of absorbed liquid, and desirably can be at least at least about 50 g. The total absorbent capacity can alternatively be at least about 100 g, and can optionally be at least about 200 g to provide improved performance. In addition, the total absorbent capacity can be not more than about 1200 g. Alternatively, the total absorbent capacity can be not more than about 800 g, and optionally, can be not more than about 600 g to provide improved benefits.

These values are important because they can provide the product with an desired combination of sufficient absorbent capacity and good comfort and fit throughout the product life cycle. Values below the low end of the capacity range can cause the product to leak prematurely due to insufficient capacity. Values above the high end of the capacity range can cause the product to sag or gap during use due to an excessive weight of absorbed liquid.

The retention portion may include substantially no superabsorbent material. Further aspects of the invention, however, can include a retention portion **48** having super-

absorbent material in an amount which is at least about 10 wt %, and alternatively, is at least about 15 wt % to provided improved performance. Additionally, the amount of superabsorbent material can be not more than about 65 wt %, and alternatively, can be not more than about 50 wt % to provide desired benefits. These values are important because they can provide the product article with sufficient capacity at a product thinness level that is desired by consumers. Products with excessively low amounts superabsorbent materials can be more likely to leak prematurely and can be too thick for comfortable wear. Products using larger amounts of superabsorbent materials can look floppy, bunched and wrinkled due to a lack of structural integrity in the retention portion, resulting in poor product appearance, poor fit, poor comfort and poor resistance to leakage.

The superabsorbent material can also be provided at a basis weight which is at least about 5 g/m^2, and alternatively, is at least about 10 g/m^2 to provide improved performance. In addition, the superabsorbent basis weight can be not more than about 950 g/m^2. Alternatively, the incremental absorbent capacity can be not more than about 650 g/m^2, and optionally, can be not more than about 400 g/m^2 to provide improved benefits. These values are important because they can provide the product with sufficient capacity along with a low product thinness that is desired by consumers. Products with too low an amount of superabsorbent materials can be more likely to leak prematurely and can be too thick to provided desired levels of comfort when wearing the product. Products using greater amounts of superabsorbent materials can look floppy, bunched and wrinkled due to a lack of integrity of the absorbent structure. The low integrity can cause poor appearance, poor fit, poor comfort and excessive leakage.

In still other aspects of the invention, the retention portion can include elastomeric fibers in an amount which is at least a minimum of about 2 wt %. The amount of elastomeric fibers can alternatively be at least about 3 wt %, and can optionally be at least about 5 wt % to provide improved performance. In addition, the amount of elastomeric fibers can be not more than about 60 wt %. Alternatively, the amount of elastomeric fibers can be not more than about 45 wt %, and optionally, can be not more than about 30 wt % to provide improved benefits. These values are important because they can provide the absorbent retention portion with desired levels of stretchability and structural stability without excessively degrading the physical properties or the liquid-management properties of the absorbent structure. An absorbent retention portion with an excessively low proportion of elastomeric fibers may be insufficiently stretchable, and a retention portion with an excessively high proportion of elastomeric fibers may exhibit an excessive degradation of its absorbency functionalities, such as poor intake, poor distribution, poor retention of liquid and/or an excessive tension force when stretched.

The elastomeric fibers can also be provided at a basis weight which is at least about 1 g/m^2. The basis weight can alternatively be at least about 5 g/m^2, and can optionally be at least about 10 g/m^2 to provide improved performance. In addition, the basis weight can be not more than about 700 g/m^2. The basis weight can alternatively be not more than about 500 g/m^2, and can optionally be not more than about 300 g/m^2 to provide improved benefits. These values are important because they can provide the absorbent retention portion with desired levels of stretchability and structural stability without excessively degrading the physical properties or the liquid-management properties of the absorbent structure. An absorbent retention portion with an excessively low basis weight of elastomeric fibers may be insufficiently stretchable, and a retention portion with an excessively high basis weight of elastomeric fibers may exhibit an excessive degradation of its absorbency functionalities, such as poor intake, poor distribution, poor retention of liquid and/or an excessive resistance to stretching.

The retention portion may include substantially no absorbent fibrous material. In desired aspects of the invention, however, the retention portion can include absorbent fibers in an amount which is at least a minimum of about 10 wt %, and alternatively, is at least about 20 wt % to provided improved performance. Additionally, the amount of absorbent fibers can be not more than about 98 wt %. The amount of absorbent fibers can alternatively be not more than about 90 wt %, and can optionally be not more than about 80 wt % to provide improved benefits. These values are important because they can provide the product with sufficient absorbent capacity while also providing a desired product thinness. Products with an excessively high amount of absorbent fibers can become too thick and feel uncomfortable to the wearer. Products using an excessively low amount of absorbent fibers can look floppy, bunched and wrinkled due to a lack of integrity in the absorbent structure. The low integrity can cause in poor product appearance, poor fit, poor comfort, and excessive leakage.

The absorbent fibers can also be provided at a basis weight which is at least about 10 g/m^2, and alternatively is at least about 40 g/m^2 to provide improved performance. In addition, the basis weight can be not more than about 1180 g/m^2. The basis weight can alternatively be not more than about 900 g/m^2, and can optionally be not more than about 640 g/m^2 to provide improved benefits. These values are important because they can provide the product with sufficient capacity along with a product thinness that is desired by consumers. Products with an amount of absorbent fibers that is too high can be excessively thick and can feel uncomfortable to the wearer. Products with an amount of absorbent fibers that is too low can look floppy, bunched and wrinkled due to a lack of structural integrity. The low integrity can cause poor product appearance, poor fit, poor comfort and excessive leakage.

With reference to FIG. 3, the retention portion 48 may include an elastomeric coform material. In particular aspects, the elastomeric coform material can have an overall coform basis weight which is at least a minimum of about 50 g/m^2. The coform basis weight can alternatively be at least about 100 g/m^2, and can optionally be at least about 200 g/m^2 to provide improved performance. In addition, the coform basis weight can be not more than about 1200 g/m^2. Alternatively, the coform basis weight can be not more than about 900 g/m^2, and optionally, can be not more than about 800 g/m^2 to provide improved benefits. These values are important because they can provide the absorbent core with desired stretchability and structural stability without excessively degrading the physical properties or the liquid-management functionalities of the retention portion. Retention portions having excessively low proportions of elastomeric coform material may not be sufficiently stretchable. Retention portions having excessively large amounts of elastomeric coform materials can exhibit an excessive degradation of their absorbency functionalities, such as an excessive degradation of intake, distribution and/or retention properties.

Further configurations of the invention can include other materials such as, cellulosic fibers, nonwoven webs, laminates or layers of superabsorbent and non-superabsorbent containing materials, foams, particulates, thermoplastic

super absorbent, meltblown particulates, superabsorbent web, waffle, aggregates, modified fiber, synthetic fibers, surfactants, treatments, elastomeric materials, binders, or combinations thereof. Cellulosic fibers may be in the form of modified cellulose, cellulosic and comminuted wood pulp, rayon, cotton, hard and soft woods.

In particular, the retention portion may or may not include a selected amount of an internal or external surface-active agent. Examples of such surface-active agents include TRITON X-102 available from Union Carbide Chemicals and Plastics Company, Inc. located in Danbury, Conn.; LUBRIZOL 85870 available from Lubrizol Corp located in Wickliffe, Ohio; Y12488 produced by OSI Specialties, Inc. located in Tarrytown, N.Y.; AHCOVEL N-62 surfactant from ICI Americas, Inc. located in Wilmington, Del.; and GLUCOPON 220UP surfactant from Henkel Corporation—Emery Group located in Cincinnati, Ohio, as well as combinations thereof.

The surface-active agent can be included in an amount of at least a minimum of about 0.05 wt % of the total weight of the retention portion, and alternatively, can be included in an amount of 0.1 wt % to provide improved performance. Additionally, the amount of surface-active agent can be not more than a maximum of about 3 wt %. The amount of surface-active agent can alternatively be not more than about 2 wt %, and can optionally be not more than about 1 wt % to provide improved benefits. The presence of surface-active agent can advantageously improve the intake performance of the absorbent structure. If the amount of surface-active agent is too high, however, there can be an excessive decrease in the surface tension of the absorbent material, and poor wicking performance.

In desired aspects, the retention portion **48** can have a dry thickness which is at least a minimum of about 0.5 mm, as determined under a restraining pressure of 1.38 KPa. The dry thickness can alternatively be at least about 0.75 mm, and can optionally be at least about 1 mm to provide improved performance. In further aspects, the retention portion **48** can have a dry thickness which is not more than a maximum of about 12 mm. The dry thickness can alternatively be not more than about 10 mm, and can optionally be not more than about 8 mm to provide improved benefits.

In still other aspects, the retention portion **48** can have a dry density which is at least a minimum of about 0.03 g/cm3 as determined under a restraining pressure of 1.38 KPa. The dry density can alternatively be at least about 0.05 g/cm^3, and can optionally be within at least about 0.1 g/cm^3 to provide improved performance. Additionally, the retention portion **48** can have a dry density which is not more than a maximum of about 0.4 g/cm^3. The dry density can alternatively be not more than about 0.3 g/cm^3, and can optionally be not more than about 0.25 g/cm^3 to provide improved benefits.

The retention portion **48**, in still further aspects, can have a dry tensile strength value which is at least a minimum of about 0.5 Newtons per cm of width (N/cm), as determined by tensioning along the longitudinal direction 26 of the article. The dry tensile strength can alternatively be at least about 1 N/cm, and can optionally be at least about 1.5 N/cm to provide improved performance. Additionally, the retention portion **48** can have a dry tensile strength value which is not more than a maximum of about 4 N/cm, as determined along the longitudinal direction of the article. The dry tensile strength can alternatively be not more than about 3 N/cm, and can optionally be not more than about 2.5 N/cm to provide improved benefits.

With reference to FIGS. **4**, **4A** and **5**, the absorbent article may further include a supplemental absorbent layer **44**. The supplemental absorbent layer may be positioned on an appointed outward side of the absorbent body structure **32** (e.g. FIGS. **4** and **4A**), or may be positioned on an appointed body side of the absorbent body structure (e.g. FIG. **5**). The supplemental layer **44** and the retention portion **48** may have substantially the same shape and area-size (e.g. FIG. **4**), or may have different shapes and area-sizes (e.g. FIG. **5**). Where the supplemental layer provides an intake or distribution layer, the distribution or intake layer can contain a matrix of fibers, such as cellulosic, wood pulp fluff fibers, with substantially no superabsorbent material. Alternatively, the distribution or intake layer can contain at least about 5 wt % of superabsorbent polymer material, as determined with respect to a total weight of the supplemental, distribution or intake layer, and may optionally contain at least about 10 wt % of superabsorbent material to provide improved benefits. Additionally, the amount of superabsorbent material in the distribution or intake layer can be not more than about 50 wt %. The amount of superabsorbent material in the distribution or intake layer can alternatively be not more than about 40 wt %, and optionally can be not more than about 30 wt % to provide improved performance. The distribution or intake layer can also be positioned on a body side or an outward side of the primary retention portion **48**, as desired.

Where the supplemental layer **44** provides a supplemental retention layer, the supplemental retention layer can contain a mixture of wood pulp fluff fibers with at least about 5 wt % of superabsorbent material. Alternatively, the supplemental retention layer can contain at least about 10 wt % of superabsorbent polymer material, as determined with respect to a total weight of the supplemental retention layer, and may optionally contain at least about 20 wt % of superabsorbent material to provide improved benefits. Additionally, the amount of superabsorbent material in the supplemental retention layer can be not more than about 80 wt %. The amount of superabsorbent material in the supplemental retention layer can alternatively be not more than about 65 wt %, and optionally can be not more than about 50 wt % to provide improved performance. Also, the supplemental retention layer can be positioned on a body side or an outward side of the primary retention portion **48**, as desired.

In desired aspects, the retention portion **48** can be substantially elastomerically stretchable. For example, the retention portion can include elastomeric materials, such as elastomeric polymers, elastomeric urethanes, and natural rubbers. The elastomeric materials can be in form of films, meltblown fibers, spunbond fibers, strands, webs, continuous fibers or fibers. Examples of elastomeric materials can include KRATON, HYTREL, ESTANE, LYCRA or PEBAX elastomers. The absorbent material can be made in an airlaid process, spunbond process, air-formed process, carding process, foam process, wet laid process, or meltblown process, as well as combinations thereof. Additional processes that may improve the form and elasticity of the absorbent materials can include creping, heat treating, chemically treating, aperturing, embossing, micro-straining, and corrugating the absorbent, as well as combinations thereof.

Suitable absorbent structures and retention portions are described in U.S. patent application Ser. No. 09/197,268 entitled ELASTIC ABSORBENT STRUCTURES by Debra Jean McDowall et al. filed Nov. 20, 1998. The entire disclosure of this document is incorporated herein by reference in a manner that is consistent herewith.

In particular aspects of the invention, the retention portion **48** can have a retention portion elongation-at-peak-load value which is at least a minimum of about 10%. Alternatively, the retention portion elongation-at-peak-load value can be at least about 30%, and optionally, can be at least about 40% to provide improve performance. In other aspects, the retention portion elongation-at-peak-load value can be up to a maximum of about 500%, or more. The retention portion elongation-at-peak-load value can alternatively be up to about 300%, and optionally, can be up to about 200%, or more, to provide improved benefits.

Further aspects of the invention can include a retention portion **48** having an elongation-at-break-load value (elongation-at-break value) which is at least a minimum of about 50%. The retention portion can alternatively have an elongation-at-break value which is at least about 75%, and optionally is at least about 100% to provide improved performance. In additional aspects, the retention portion **48** can have an elongation-at-break-load value which is not more than a maximum of about 500%. The retention portion can alternatively have an elongation-at-break value which is not more than about 300%, and optionally is not more than about 200% to provide improved benefits.

In typical, non-stabilized absorbent structures, the percent elongation-at-peak-load value approximately equals the elongation-at-break value. After the typical, non-stabilized absorbent structures have been subjected to their elongation-at-peak-load value, the absorbent structures can exhibit undesired bunching, separation, or poor integrity and can provide inadequate absorbent performance.

In the elastomeric retention portion employed in the present invention, however, both the elongation-at-peak-load value and the elongation-at-break value are important, and the two values can be different. The elastomeric retention portion can be in an operative condition after it has been subjected to its peak-load force, and can remain in an operative condition until it has been subjected to its break-load force. As a result, the elastomeric retention portion employed in the present invention can exhibit reduced bunching, reduced separation, and improved integrity following the elongation generated at the peak load.

The article of the invention can also include a distinctive combination of tensile strength and elongation properties. In particular aspects, the article can provide an overall, composite-article tensile load force value which is at least a minimum of about 250 grams per inch (about 0.97 N/cm), as determined at a composite-article elongation of 45%. The article load value can alternatively be at least about 300 g/inch (about 1.16 N/cm), and optionally, can be at least about 350 g/inch (about 1.35 N/cm) to provide improved performance. In other aspects, the article can provide an article tensile load value which is not more than a maximum of about 750 g/inch (about 2.9 N/cm), as determined at the article elongation of 45%. The article load value can alternatively be not more than about 600 g/inch (about 2.9 N/cm), and optionally, can be not more than about 450 g/inch (about 2.9 N/cm) to provide improved benefits.

The article of the invention can also provide a composite-article elongation value which is at least a minimum of about 4% when subjected to a tensile force of 100 g/inch (0.386 N/cm). Alternatively, the article elongation value can be at least about 5%, and optionally, can be at least about 7% to provide improve performance. In other aspects, the article elongation value can be up to a maximum of about 50%, or more. The article elongation value can alternatively be up to about 25%, and optionally, can be up to about 15%, to provide desired performance.

In other aspects, the article can provide a composite-article elongation-at-peak-load value which is at least a minimum of about 45%, and desirably, is at least about 50%. The article elongation-at-peak-load value can alternatively be at least about 60%, and can optionally be at least about 70% to provide improved performance. In addition, the article elongation-at-peak-load value can be not more than about 500%. Alternatively, the article elongation-at-peak-load value can be not more than about 350%, and optionally, can be not more than about 200% to provide improved benefits.

A product having the advantageous elongation-at-peak-load value does not suffer from the many deficiencies associated with non-stretch products, but instead provides the distinctive benefits to the wearer. Products with less than the desired elongation-at-peak-load values do not provide a clearly recognizable level of these benefits to the wearer. Such benefits can, for example, include a flexible body-conforming fit that provides a trim and appealing underwear-like appearance. The improved article can also provide reduced gapping and can increase the efficiency of the product with regard to containing and absorbing urine and feces with reduced leakage. The article can better survive wear-related stresses, can reduce product deformation, bunching, and breaking apart during use, and can provide superior comfort. Additionally, the article can provide a self-adjusting fit which can maintain a desired position and body coverage regardless of the wearer's position and activity. The article can also be easier to apply due to its ability to conform to the wearer's body while product is worn. The article can fit a broader size range, and can provide less binding or restriction. Instead, the article can more readily move with the wearer, and allow a more natural and free level of mobility.

In desired aspects, a quotient of an elongation value of the backsheet member **30** divided by the elongation value of the composite article can be at least minimum of about 1.1, where each elongation value is determined at a tensile loading of 100 grams per inch (0.386 N/cm). To determine the quotient, the elongation value of each stated component is measured separately. Each stated component is separately subjected to the described tensile loading to determine the elongation value for the individual component. After independently measuring the individual elongation values, the quotient can be calculated. The quotient can alternatively be at least about 1.2, and can optionally be at least about 1.3 to provide improved performance. In addition, the quotient can be not more than about 20. Alternatively, the incremental absorbent capacity can be not more than about 10, and optionally, can be not more than about 2 to improved benefits.

The quotient of the backsheet member elongation to the total product elongation within the selected values can be advantageous, since an article with a quotient that is too low does not provide sufficient stretch of the backsheet member to allow the article to maintain a trim appearance, good body conformance/coverage, and resist gapping as the product undergoes wear. Also, a product with excessively low quotient values does not allow sufficient stretch of the backsheet member to accommodate the space required in the product to accept bowel movements and to accommodate the swelling of the absorbent that occurs as a result of multiple voidings of urine. Products having excessively high quotients can exhibit over-conformance, excessive wrinkling of the backsheet member, excessive body folding/creasing and excessive loss of the highly desirable smooth appearance along the outside surface of the backsheet member. Products

with quotient values that are too high can cause the other components of the product to fold and buckle, and can degrade the wearer's comfort. Also, products with excessively high quotient values can exhibit an excessive pulling by the backsheet member, which can result in excessive gapping in the waist regions, excessive bunching in the crotch region, poor fit and poor absorbent efficiency.

In other aspects, a quotient of an elongation value of the retention portion **48** divided by the elongation value of the composite article can be at least a minimum of about 1.01, where each elongation value is determined at a tensile loading of 100 grams per inch (0.386 N/cm). To determine the quotient, the elongation value of each stated component is measured separately. Each stated component is separately subjected to the described tensile loading to determine the elongation value for the individual component. After independently measuring the individual elongation values, the quotient can be calculated. The quotient can alternatively be at least about 1.1, and can optionally be at least about 1.2 to provide improved performance. Additionally, the incremental absorbent capacity can be not more than a maximum of about 5. Alternatively, the incremental absorbent capacity can be not more than about 3, and optionally, can be not more than about 2 to provide improved benefits.

When the quotient of the elongation of the retention portion divided by the elongation of the total product is too low, the absorbent can excessively restrict the stretch properties and associated benefits of the product, particularly in the arrangement where the retention portion has greater strength than the other components of the product. When the strength of the absorbent retention portion is less than the other components and the quotient is too low, the absorbent can exhibit an excessive amount of breakage and clumping during use, and can exhibit poor absorbency and uncomfortable fit.

Products having excessively high quotient values of the elongation of the retention portion divided by the elongation of the total product can exhibit excessive deformation, buckling, and wrinkling of the absorbent within the product. The products can also exhibit an undesired loss of trim fit and smooth appearance, as well as excessive gapping and reduced efficiency of the absorbent. Additionally, products with excessively high quotient values can incorporate excessive amounts of elastic components into the absorbent, which raises raw material and manufacturing expenses without providing a cost effective benefit.

In further aspects, a quotient of an elongation value of the retention portion **46** divided by an elongation value of the backsheet member **30** can be at least about 0.06, where each elongation value is determined at a tensile loading of 100 grams per inch (0.386 N/cm). To determine the quotient, the elongation value of each stated component is measured separately. Each stated component is separately subjected to the described tensile loading to determine the elongation value for the individual component. After independently measuring the individual elongation values, the quotient can be calculated. The quotient of the elongation of the retention portion divided by the elongation of the backsheet member can alternatively be at least about 0.1, and can optionally be at least about 0.2 to provide improved performance. In addition, the quotient can be not more than a maximum of about 0.95. Alternatively, the incremental absorbent capacity can be not more than about 0.75, and optionally, can be not more than about 0.5 to provide improved benefits.

If the quotient of the absorbent elongation divided by the backsheet member elongation is too low, the article does not allow the absorbent retention portion to stretch enough, and the insufficient stretch can cause the backsheet member to be excessively constrained by the retention, resulting in poor fit and performance. If the quotient values are too high, the article may not sufficiently maintain the desired shape of the retention portion, but instead, can allow the retention portion to excessively mold to the body contours, causing a wrinkled/bunched backsheet member which is highly undesirable for good fit, comfort, and appearance.

In additional aspects, a quotient of a tensile force value in the backsheet member **30** as determined at a 15% backsheet elongation, divided by a tensile force value in the composite-article, as determined at a 15% composite-article elongation, can be at least a minimum of about 0.05. To determine the quotient, the tensile force value of each stated component is measured separately. Each stated component is separately subjected to its described elongation to determine the resulting tensile force value for the individual component. After independently measuring the individual tensile force values, the quotient can be calculated. The quotient of the tensile force in the backsheet member, divided by the tensile force in the article can alternatively be at least about 0.07, and can optionally be at least about 0.1 to provide improved performance. In addition, the quotient of the tensile force in the backsheet member, divided by the tensile force in the article can be not more than about 0.9. Alternatively, the quotient can be not more than about 0.6, and optionally, can be not more than a maximum of about 0.3 to provide improved benefits.

The quotient of the tensile force in the backsheet member divided by that of the total product is too low, the backsheet member may not provide sufficient strength to resist in-use product deformation and breakage forces, resulting in poor product fit and functionality. If the quotient value is too high, the force required to elongate the backsheet member relative to the total product can become excessive, causing reduced product conformance, poor fit, and gapping induced absorbent inefficiency.

In still other aspects, a quotient of a tensile force in the retention portion **48**, as determined at a 15% retention portion elongation, divided by a tensile force in the composite-article, as determined at a 15% composite-article elongation, can be at least a minimum of about 0.1. To determine the quotient, the tensile force value of each stated component is measured separately. Each stated component is separately subjected to its described elongation to determine the resulting tensile force value for the individual component. After independently measuring the individual tensile force values, the quotient can be calculated. The quotient can alternatively be at least about 0.5, and can optionally be at least about 0.6 to provide improved performance. In addition, the quotient of the tensile force in the retention portion, divided by the tensile force in the article can be not more than a maximum of about 0.99. Alternatively, the quotient can be not more than about 0.8, and optionally, can be not more than about 0.7 to provide improved benefits.

If the quotient of the tensile force in the retention portion, divided by the tensile force in the composite article is too low, the article may not have enough strength to prevent excessive deformation and breaking during product use, leading to poor fit and absorbent efficiency. If the quotient value is too high, the load required to stretch the absorbent becomes excessively higher than the loads needed to stretch the other product components. As a result, the absorbent may not stretch in concert with the other diaper components but may instead degrade overall product conformance,

coverage, and absorbent efficiency. If the applied force is sufficient to elongate the other product components, but not sufficient to elongate the absorbent retention portion, then the other product components can separate away from the retention portion, leading to excessive product deformation and poor fit.

In still further aspects, a tensile force in the retention portion **48**, as determined at a 15% retention portion elongation divided by a tensile force in the backsheet member **30**, as determined at a 15% backsheet elongation, can be at least a minimum of about 1.5. To determine the quotient, the tensile force value of each stated component is measured separately. Each stated component is separately subjected to its described elongation to determine the resulting tensile force value for the individual component. After independently measuring the individual tensile force values, the quotient can be calculated. The tensile force in the retention portion, divided by the tensile force in the backsheet member can alternatively be at least about 2.5, and can optionally be at least about 5 to provide improved performance. In addition, the quotient of the tensile force in the retention portion, divided by the tensile force in the backsheet member can be not more than about 8. Alternatively, the quotient can be not more than about 7, and optionally, can be not more than about 6 to provide improved benefits.

If the quotient of the tensile force in the retention portion, divided by the tensile force in the backsheet member is too low, the absorbent may not provide sufficient strength to resist in-use backsheet member deformation and breakage forces, resulting in poor product fit and functionality. If the quotient value is too high, the force required to elongate the absorbent retention portion relative to the backsheet member can become excessive, and can cause a reduced product conformance, poor fit, gapping and excessive leakage.

The physical properties, such as tensile strength, tensile load and elongation, of a material or component can be determined by conventional techniques that are well known in the art. A suitable technique can incorporate ASTM procedure D 3039 "Tensile Properties of Polymer Matrix Composite Materials", as described below in the Tensile Testing section of the Procedures portion of the present disclosure.

To improve the containment of the high-absorbency material, absorbent body structure **32** may include an overwrap, such as wrap sheet **74**, which is placed immediately adjacent and around absorbent body **32** and may be bonded to the absorbent structure and to the various other components of the article. The wrap sheet is preferably a layer of absorbent material which covers the major bodyside and outerside surfaces of the absorbent body, and preferably encloses substantially all of the peripheral edges of the absorbent body to form a substantially complete envelope thereabout. Alternatively, the wrap sheet can provide an absorbent wrapping which covers the major bodyside and outerside surfaces of the absorbent body, and encloses substantially only the lateral side edges of the absorbent body. Accordingly, both the linear and the inwardly curved portions of the lateral side edges of the wrap sheet would be closed about the absorbent body. In such an arrangement, however, the end edges of the wrap sheet may not be completely closed around the end edges of the absorbent body at the waistband regions of the article.

For example, the complete wrap sheet **74**, or at least the bodyside layer of the wrap sheet, may comprise a meltblown web composed of meltblown fibers, such as meltblown polypropylene fibers. Another example of absorbent wrap **74** may comprise a low porosity cellulosic web, such as a tissue composed of an approximately 50/50 blend of hardwood/softwood fibers.

The absorbent wrap **74** may comprise a multi-element wrapsheet which includes a separate bodyside wrap layer and a separate outerside wrap layer, each of which extends past all or some of the peripheral edges of absorbent body **32**. Such a configuration of the wrap sheet can, for example, facilitate the formation of a substantially complete sealing and closure around the peripheral edges of absorbent body **32**. In the back waistband portion of the illustrated diaper, the absorbent wrap may also be configured to extend an increased distance away from the periphery of the absorbent body to add opacity and strength to the back side-sections of the diaper. In the illustrated embodiment, the bodyside and outerside layers of absorbent wrap **74** can extend at least about ½ inch beyond the peripheral edges of the absorbent body to provide an outwardly protruding, flange-type bonding area over which the periphery of the bodyside portion of the absorbent wrap may be completely or partially connected to the periphery of the outerside portion of the absorbent wrap.

The bodyside and outerside layers of wrap sheet **74** may be composed of substantially the same material, or may be composed of different materials. For example, the outerside layer of the wrap sheet may be composed of a relatively lower basis weight material having a relatively high porosity, such as a wet strength cellulosic tissue composed of softwood pulp. The bodyside layer of the wrap sheet may comprise one of the previously described wrap sheet materials which has a relatively low porosity. The low porosity bodyside layer can better prevent the migration of superabsorbent particles onto the wearer's skin, and the high porosity, lower basis weight outerside layer can help reduce costs.

Diaper **10** can also include a surge management layer **46** which helps to decelerate and diffuse surges or gushes of liquid that may be rapidly introduced into the absorbent body of the article. Desirably, the surge management layer can rapidly accept and temporarily hold the liquid prior to releasing the liquid into the storage or retention portions of the absorbent structure. In the illustrated embodiment, for example, surge layer **46** can be located on an inwardly facing body side surface of topsheet layer **28**. Alternatively, surge layer **46** may be located adjacent to an outer side surface of topsheet **28**. Accordingly, the surge layer would then be interposed between topsheet **28** and absorbent body **32**. Examples of suitable surge management layers **46** are described in U.S. patent application Ser. No. 206,986 of C. Ellis and D. Bishop, entitled FIBROUS NONWOVEN WEB SURGE LAYER FOR PERSONAL CARE ABSORBENT ARTICLES AND THE LIKE, filed Mar. 4, 1994 which corresponds to U.S. Pat. No. 5,486,166; and U.S. patent application Ser. No. 206,069 of C. Ellis and R. Everett, entitled IMPROVED SURGE MANAGEMENT FIBROUS NONWOVEN WEB FOR PERSONAL CARE ABSORBENT ARTICLES AND THE LIKE, filed Mar. 4, 1994 which corresponds to U.S. Pat. No. 5,490,846. Other suitable surge management materials are described in U.S. patent application Ser. No. 754,417 filed Nov. 22, 1996 and entitled HETEROGENEOUS SURGE MATERIAL FOR ABSORBENT ARTICLES by R. Dodge et al. which corresponds to U.S. Pat. No. 5,820,973 issued Oct. 13, 1998. The entire disclosures of these documents are hereby incorporated by reference in a manner that is consistent herewith.

The article of the invention may or may not include leg elastic members **34**. Where the leg elastic members are

included, the leg elastic members **34** can be located in the lateral side margins of the article. In the shown diaper **10**, for example, the leg elastic members are assembled into the lateral side margins **20**, and are arranged to draw and hold the diaper against the legs of the wearer. The elastic members are secured to diaper **10** in an elastically contractible condition so that in a normal under strain configuration, the elastic members effectively contract against diaper **10**. The elastic members can be secured in an elastically contractible condition in at least two ways, for example, the elastic members may be stretched and secured while diaper **10** is in an uncontracted condition. Alternatively, diaper **10** may be contracted, for example, by pleating, and the elastic members secured and connected to diaper **10** while the elastic members are in their relaxed or unstretched condition. Still other mechanisms, such as heat-shrink elastic material, may be used to gather the garment.

In the embodiment illustrated in FIGS. **1** and **2**, the leg elastic members **34** extend essentially along the complete length of the intermediate crotch region **16** of diaper **10**. Alternatively, elastic members **34** may extend the entire length suitable for providing the arrangement of elastically contractible lines desired for the particular diaper design.

The elastic members **34** may have any of a multitude of configurations. For example, the width of the individual elastic members **34** may be varied from about 0.25 millimeters (0.01 inch) to about 25 millimeters (1.0 inch) or more. The elastic members may comprise a single strand of elastic material, or may comprise several parallel or non-parallel strands of elastic material, or may be applied in a rectilinear or curvilinear arrangement. Where the strands are non-parallel, two or more of the strands may intersect or otherwise interconnect within the elastic member. The elastic members may be affixed to the diaper in any of several ways which are known in the art. For example, the elastic members may be ultrasonically bonded, heat and pressure sealed using a variety of bonding patterns, or adhesively bonded to diaper **10** with sprayed or swirled patterns of hotmelt adhesive.

In particular embodiments of the invention, the leg elastic members **34** may include a carrier sheet to which are attached a grouped set of elastics composed of a plurality of individual elastic strands. The elastic strands may intersect or be interconnected, or be entirely separated from each other. The carrier sheet may, for example, comprise a 0.002 cm thick polymer film, such as a film of unembossed polypropylene material. The elastic strands can, for example, be composed of LYCRA elastomer available from DuPont, a business having offices in Wilmington, Del. Each elastic strand is typically within the range of about 470–1500 decitex (dtx), and may be about 940–1050 dtx. In particular embodiments of the invention, for example, three or four strands can be employed for each elasticized legband.

In addition, the leg elastics **34** may be generally straight or optionally curved. For example, the curved elastics can be inwardly bowed toward the longitudinal centerline of the diaper. In particular arrangements, the curvature of the elastics may not be configured or positioned symmetrically relative to the lateral centerline of the diaper. The curved elastics may have an inwardly bowed and outwardly bowed, reflex-type of curvature, and the length-wise center of the elastics may optionally be offset by a selected distance toward either the front or rear waistband of the diaper to provide desired fit and appearance. In particular embodiments of the invention, the innermost point (apex) of the set of curved elastics can be offset towards the front or rear waistband of the diaper, and the outwardly bowed reflexed-portion can be positioned toward the diaper front waistband.

As representatively shown, the diaper **10** can include a waist elastic **42** positioned in the longitudinal margins of either or both of the front waistband **14** and the rear waistband **12**. The waist elastics may be composed of any suitable elastomeric material, such as an elastomer film, an elastic foam, multiple elastic strands, an elastomeric fabric or the like. For example, suitable elastic waist constructions are described in U.S. Pat. No. 4,916,005 to Lippert et al., the entire disclosure of which is hereby incorporated by reference in a manner that is consistent herewith.

With reference to the representative configurations shown in FIGS. **1** and **2**, the article can include a system of "ear" regions or ear members **38**. In particular arrangements, each ear region or member **38** extends laterally at the opposed, lateral ends of at least one waistband portion of backsheet **30**, such as the representatively shown rear waistband portion **12**, to provide terminal side sections of the article. In addition, each ear region can substantially span from a laterally extending, terminal waistband edge to approximately the location of its associated and corresponding leg opening section of the diaper. The diaper **10**, for example, has a laterally opposed pair of leg openings provided by the curved margins of the ear regions in combination with the correspondingly adjacent, medial sections of the shown pair of longitudinally extending, side edge regions **20** (FIG. **1**).

In the various configurations of the invention, the ear regions may be integrally formed with a selected diaper component. For example, ear regions **38** can be integrally formed from the layer of material which provides backsheet member **30**, or may be integrally formed from the material employed to provide topsheet **28**. In alternative configurations, the ear regions **38** may be provided by one or more separately provided members that are connected and assembled to the backsheet **30**, to the topsheet **28**, in between the backsheet and topsheet, or in various fixedly attached combinations of such assemblies.

In particular configurations of the invention, each of the ear regions **38** may be formed from a separately provided piece of material which is then suitably assembled and attached to the selected front and/or rear waistband portion of the diaper article. For example, each ear region **38** may be attached to the rear waistband portion of the backsheet **30** along a ear region attachment zone, and can be operably attached to either or both of the backsheet and topsheet components of the article. The inboard, attachment zone region of each ear region can be overlapped and laminated with its corresponding, lateral end edge region of the waistband section of the article. The ear regions extend laterally to form a pair of opposed waist-flap sections of the diaper, and are attached with suitable connecting means, such as adhesive bonding, thermal bonding, ultrasonic bonding, clips, staples, sewing or the like. Desirably, the ear regions extend laterally beyond t terminal side edges of the backsheet member and topsheet layer at the corresponding, attached waistband section of the article.

The ear regions **38** may be composed of a substantially non-elastomeric material, such as polymer films, woven fabrics, nonwoven fabrics or the like, as well as combinations thereof. In particular aspects of the invention, ear regions **38** may be composed of a substantially elastomeric material, such as a stretch-bonded-laminate (SBL) material, a neck-bonded-laminate (NBL) material, an elastomeric film, an elastomeric foam material, or the like, which is elastomerically stretchable at least along the lateral direction

24. For example, suitable meltblown elastomeric fibrous webs for forming ear regions **38** are described in U.S. Pat. No. 4,663,220 issued May 5, 1987 to T. Wisneski et al., the entire disclosure of which is hereby incorporated by reference. Examples of composite fabrics comprising at least one layer of nonwoven textile fabric secured to a fibrous elastic layer are described in European Patent Application EP 0 217 032 A2 published on Apr. 8, 1987 which has the listed inventors of J. Taylor et al., the entire disclosure of which is hereby incorporated by reference. Examples of NBL materials are described in U.S. Pat. No. 5,226,992 issued Jul. 13, 1993 to Mormon, the entire disclosure of which is hereby incorporated by reference.

As previously mentioned, various suitable constructions can be employed to attach the ear regions **38** to the selected waistband portions of the article. Particular examples of suitable constructions for securing a pair of elastically stretchable members to the lateral, side portions of an article to extend laterally outward beyond the laterally opposed side regions of the outer cover and liner components of an article can be found in U.S. Pat. No. 4,938,753 issued Jul. 3, 1990 to P. VanGompel et al., the entire disclosure of which is hereby incorporated by reference in a manner that is consistent herewith.

Each of the ear regions **38** extends laterally at a one of the opposed lateral ends of at least one waistband section of the diaper **10**. In the shown embodiment, for example, a first pair of ear regions extend laterally at the opposed lateral ends of the back waistband section of the backsheet **30**, and a second pair of ear regions extend laterally at the opposed lateral ends of the front waistband section of the backsheet. The illustrated ear regions have a tapered, curved or otherwise contoured shape in which the longitudinal length of the relatively inboard base region is larger or smaller than the longitudinal length of its relatively outboard end region. Alternatively, the ear regions may have a substantially rectangular shape, and optionally may have a substantially trapezoidal shape.

Diaper **10** can also include a pair of elasticized containment flaps **62** which extend generally length-wise along the longitudinal direction **26** of the diaper. The containment flaps are typically positioned laterally inboard from leg elastics **34**, and substantially symmetrically placed on each side of the lengthwise, longitudinal centerline of the diaper. In the illustrated arrangements, each containment flap **62** has a substantially fixed edge portion **64** and a substantially moveable edge portion **66**, and is operably elasticized to help each containment flap to closely contact and conform to the contours of the wearer's body. Examples of suitable containment flap constructions are described in U.S. Pat. No. 4,704,116 issued Nov. 3, 1987, to K. Enloe, the entire disclosure of which is hereby incorporated by reference in a manner that is consistent herewith. The containment flaps may be composed of a wettable or a non-wettable material, as desired. In addition, the containment flap material may be substantially liquid-impermeable, may be permeable to only gas or may be permeable to both gas and liquid. Other suitable containment flap configurations are described in U.S. patent application Ser. No. 206,816 of R. Everett et al., filed Mar. 4, 1994 and entitled ABSORBENT ARTICLE HAVING AN IMPROVED SURGE MANAGEMENT, which corresponds to U.S. Pat. No. 5,562,650, the disclosure of which is hereby incorporated by reference in a manner that is consistent herewith.

In optional, alternative configurations of the invention, diaper **10** may include internal, elasticized, containment waist flaps, such as those described in U.S. Pat. No. 4,753,646 issued Jun. 28, 1988, to K. Enloe, and in U.S. patent application Ser. No. 560,525 of D. Laux et al. entitled AN ABSORBENT ARTICLE WITH IMPROVED ELASTIC MARGINS AND CONTAINMENT SYSTEM and filed Dec. 18,1995, the entire disclosures of which are hereby incorporated by reference in a manner that is consistent herewith. Similar to the construction of the containment flaps, the containment waist flaps may be composed of a wettable or non-wettable material, as desired. The waist flap material may be substantially liquid-impermeable, permeable to only gas, or permeable to both gas and liquid.

To provide a desired refastenable fastening system, diaper **10** can include one or more, appointed landing member regions or patches, such as provided by the representatively shown, primary landing member **50**. The landing member can provide an operable target area for generating a releasable and re-attachable securement with at least one of the fastener tabs **36**. In desired embodiments of the invention, the landing member patch can be positioned on the front waistband portion **14** of the diaper and located on the outward surface of the backsheet member **30**. Alternatively, the landing member patch can be positioned on an appointed inward surface of the diaper, such as the bodyside surface of the topsheet layer **28**.

Particular arrangements of the invention can include one or more landing members **50** which can be directly or indirectly attached to the second waistband portion **14**. Desirably, the landing members are affixed directly to the outward surface of the appropriate waistband portion, but may optionally be joined to the inward, bodyside surface of the article waistband portion.

In the various configurations of the invention, the landing member **50** can be composed of a substantially non-elastomeric material, such as polymer films or tapes, woven fabrics, nonwoven fabrics or the like, as well as combinations thereof. In particular configurations of the invention, the landing member may be composed of a substantially elastomeric material, such as a stretch-bonded-laminate (SBL) material, a neck-bonded-laminate (NBL) material, an elastomeric film, an elastomeric foam material, or the like, which is elastomerically stretchable at least along the lateral direction **24**.

The various configurations of the invention can include at least one separately provided fastener tab **36** located at either or both of the lateral end regions **86** of the back waistband **12**. Alternatively, the at least one separately provided fastener tab **36** can be located at either or both of the lateral end regions **88** of the front waistband **14**. The representatively shown embodiment, for example, has a laterally opposed pair of the fastener tabs **36** with a one of the fastener tabs located at each of the distal side edges of the rear waistband **12**. More particularly, each of the fasteners **36** is assembled and attached to project and extend from a corresponding, immediately adjacent ear region located at one of the opposed, lateral end regions **86** of the front waistband section **12**.

The fastener tab **36** can be composed of a substantially non-elastomeric material, such as polymer films or tapes, woven fabrics, nonwoven fabrics or the like, as well as combinations thereof. Optionally, the fastener tab may be composed of a substantially elastomeric material, such as a stretch-bonded-laminate (SBL) material, a neck-bonded-laminate (NBL) material, an elastomeric film, an elastomeric foam material, or the like, which is elastomerically stretchable at least along the lateral direction **24**.

In the various aspects and configurations of the invention, the fastening mechanism between the selected first fastener

component and the selected, second fastener component may be adhesive, cohesive, mechanical or combinations thereof. In the context of the present invention, a mechanical fastening system is a system which includes cooperating, first and second components which mechanically interengage to provide a desired securement.

Desirably, the first and second fastener components include complementary elements of a cooperatively interengaging mechanical fastening system. The mechanical fastener components can be provided by mechanical-type fasteners such as hooks, buckles, snaps, buttons and the like, which include cooperating and complementary, mechanically interlocking components.

As shown in the illustrated arrangements, for example, the mechanical fastening system may be a hook-and-loop type of fastening system. Such fastening systems generally comprise a "hook" or hook-like, male component, and a cooperating "loop" or loop-like, female component which engages and releasably interconnects with the hook component. Desirably, the interconnection is selectively releasable and re-attachable. Conventional systems are, for example, available under the VELCRO trademark. The hook element may be provided by a single-prong hook configuration, a multiple-prong hook configuration or by a generally continuous, expanded-head configuration, such as provided by a mushroom-head type of hook element. The loop element may be provided by a woven fabric, a nonwoven fabric, a knitted fabric, a perforated or apertured layer, and the like, as well as combinations thereof. The many arrangements and variations of such fastener systems have been collectively referred to as hook-and-loop fasteners.

A configuration which employs a selectively releasable, interengaging mechanical fastening system can, for example, locate the first fastener component on at least the appointed mating or securing surface of the fastener tab **36**, and can locate the cooperating, second fastener component on the appointed engagement surface of the appointed landing member **50**. For example, with the representatively shown hook-and-loop fastener, the fastening component which is attached to the appointed mating or securing surface of the fastener tab **36** may include a hook type of mechanical fastening element, and the complementary fastening component, which is operably joined and attached to the appointed landing zone member **50** can include a loop type of fastening element.

It should also be readily apparent that, in the various configurations of the invention, the relative positions and/or materials of the first fastening component and its cooperating, complementary second fastening component can be transposed. Accordingly, the fastening component, which is attached to the appointed mating surface of the fastener tabs **36**, may include a loop type of mechanical fastening element; and the complementary, second fastening component, which is operatively joined and attached to the appointed landing zone member, can include a hook type of fastening element.

Examples of hook-and-loop fastening systems and components are described in U.S. Pat. No. 5,019,073 issued May 28, 1991 to T. Roessler et al., the entire disclosure of which is hereby incorporated by reference in a manner that is consistent herewith. Other examples of hook-and-loop fastening systems are described in U.S. patent application Ser. No. 366,080 entitled HIGH-PEEL TAB FASTENER, filed Dec. 28,1994 by G. Zehner et al. which corresponds to U.S. Pat. No. 5,605,735; and U.S. patent application Ser. No. 421,640 entitled MULTI-ATTACHMENT FASTENING SYSTEM, filed Apr. 13, 1995 by P. VanGompel et al.; the entire disclosures of which are hereby incorporated by reference in a manner that is consistent herewith. Examples of fastening tabs constructed with a carrier layer are described in U.S. patent application Ser. No. 08/603,477 of A. Long et al., entitled MECHANICAL FASTENING SYSTEM WITH GRIP TAB and filed Mar. 6, 1996 which corresponds to U.S. Pat. No. 5,624,429 which issued Apr. 29, 1997, the entire disclosure of which is hereby incorporated by reference in a manner which is consistent herewith.

Each fastener tab **36** can have a variety of rectilinear or curvilinear shapes and planforms, as well as combinations thereof. For example, as illustrated in the representatively shown arrangements, the fastener tab can have a contoured, bell-shape. Alternatively, the fastener tab can have a quadrilateral, generally rectangular shape. In addition, the longitudinally extending, laterally outward, terminal edge of the fastener tab may be substantially straight. Optionally, the longitudinally extending, laterally outward, terminal edge of the fastener tab may have only a limited amount of waviness.

In the various configurations of the invention, the desired first fastener component can be a hook material which provides hook-type engagement members. An example of a suitable hook material is a micro-hook material which is distributed under the designation VELCRO HTH 829, and is available from VELCRO U.S.A., Inc., a business having offices in Manchester, New Hampshire. The micro-hook material can have hooks in the shape of angled hook elements, and can be configured with a hook density of about 264 hooks per square centimeter (about 1700 hooks per square inch); a hook height which is within the range of about 0.030–0.063 cm (about 0.012–0.025 inch); and a hook width which is within the range of about 0.007 to 0.022 cm (about 0.003 to 0.009 inch). The hook elements are coextruded with a base layer substrate having a thickness of about 0.0076–0.008 cm (about 0.003–0.0035 inch), and the member of hook material has a Gurley stiffness of about 12 mgf (about 12 Gurley units). Other suitable hook materials can include VELCRO HTH 858, VELCRO HTH 851 and VELCRO HTH 863 hook materials.

For the purposes of the present invention, the various stiffness values are determined with respect to a bending moment produced by a force which is directed perpendicular to the plane substantially defined by the length and width of the component being tested. A suitable technique for determining the stiffness values described herein is a Gurley Stiffness test, a description of which is set forth in TAPPI Standard Test T 543 om-94 (Bending Resistance of Paper (Gurley type tester)). A suitable testing apparatus is a Gurley Digital Stiffness Tester; Model 4171-D manufactured by Teledyne Gurley, a business having offices in Troy, N.Y. For purposes of the present disclosure the stated Gurley stiffness values are intended to correspond to the values that would be generated by a "standard" sized sample. Accordingly, the scale readings from the Gurley stiffness tester are appropriately converted to the stiffness of a standard size sample, and are traditionally reported in terms of milligrams of force (mgf). Currently, a standard "Gurley unit" is equal to a stiffness value of 1 mgf, and may equivalently be employed to report the Gurley stiffness.

In the various aspects and configurations of the invention, the loop material can be provided by a nonwoven, woven or knit fabric. For example, a suitable loop material fabric can be composed of a 2 bar, warp knit fabric of the type available from Guilford Mills, Inc., Greensboro, N.C. under the trade designation #34285, as well other of knit fabrics. Suitable

loop materials are also available from the 3M Company, which has distributed a nylon woven loop under their SCOTCHMATE brand. The 3M Company has also distributed a linerless loop web with adhesive on the backside of the web, and 3M knitted loop tape.

The loop material may also include a nonwoven fabric having continuous bonded areas defining a plurality of discrete unbonded areas. The fibers or filaments within the discrete unbonded areas of the fabric are dimensionally stabilized by the continuous bonded areas that encircle or surround each unbonded area, such that no support or backing layer of film or adhesive is required. The unbonded areas are specifically designed to afford spaces between fibers or filaments within the unbonded area that remain sufficiently open or large to receive and engage hook elements of the complementary hook material. In particular, a pattern-unbonded nonwoven fabric or web may include a spunbond nonwoven web formed of single component or multi-component melt-spun filaments. At least one surface of the nonwoven fabric can include a plurality of discrete, unbonded areas surrounded or encircled by continuous bonded areas. The continuous bonded areas dimensionally stabilize the fibers or filaments forming the nonwoven web by bonding or fusing together the portions of the fibers or filaments that extend outside of the unbonded areas into the bonded areas, while leaving the fibers or filaments within the unbonded areas substantially free of bonding or fusing. The degree of bonding or fusing within the bonding areas desirably is sufficient to render the nonwoven web nonfibrous within the bonded areas, leaving the fibers or filaments within the unbonded areas to act as "loops" for receiving and engaging hook elements. Examples of suitable point-unbonded fabrics are described in U.S. patent application Ser. No. 754,419 entitled PATTERN-UNBONDED NONWOVEN WEB AND PROCESS FOR MAKING THE SAME, by T. J. Stokes et al., and filed Dec. 17, 1996; the entire disclosure of which is incorporated herein by reference in a manner that is consistent herewith.

In the various configurations of the invention, the loop material need not be limited to a discrete or isolated patch on the outward surface of the article. Instead, the loop material can, for example, be provided by a substantially continuous, outer fibrous layer which is integrated to extend over substantially the total exposed surface area of a cloth-like outer cover employed with the desired article.

In the various arrangements of the invention, the engagement force between the selected first fastener component and its appointed and cooperating second fastener component should be large enough and durable enough to provide an adequate securement of the article on the wearer during use. In particular arrangements, especially where there are sufficiently high levels of engagement shear force provided by the fastening system, the fastening engagement may provide a peel force value of not less than a minimum of about 40 grams-force (gmf) per inch of the "width" of engagement between the first and second fastener components. In further arrangements, the fastening engagement may provide a peel force value of not less than about 100 gmf/inch to provide improved advantages. In desired configurations, the fastening engagement may provide a peel force value of not less than about 200 gmf per inch of the "width" of engagement between the first and second fastener components. Alternatively, the peel force is not less than about 300 gmf/inch, and optionally is not less than about 400 gmf/inch to further provide improved benefits. In other aspects, the peel force is not more than about 1,200 gmf/inch. Alternatively, the peel force is not more than about 800 gmf/inch, and optionally is not more than about 600 gmf/inch to provide improved performance.

The engagement force between the selected first fastener component and its appointed and cooperating second fastener component may additionally provide a shear force value of not less than about 400 gmf per square inch of the area of engagement between the first and second fastener components. Alternatively, the shear force is not less than about 1,000 gmf/in^2, and optionally, is not less than about 1,700 gmf/in^2. In further aspects, the shear force can be up to about 4,400 gmf/in^2, or more. Alternatively, the shear force is not more than about 3,900 gmf/in^2, and optionally is not more than about 3,500 gmf/in^2 to provide improved performance.

Desirably, the securing engagement between the first and second fastener components should be sufficient to prevent a disengagement of the fastener tab **36** away from the landing member **50** when the fastener tab **36** is subject to a tensile force of at least about 3,000 grams when the tensile force is applied outwardly along the lateral direction, aligned generally parallel with the plane of the backsheet member **30** of the article.

Each of the fastener components and fastening elements in the various constructions of the invention may be operably attached to its supporting substrate by employing any one or more of the attachment mechanisms employed to construct and hold together the various other components of the article of the invention. The fastening elements in the various fastening regions, may be integrally formed, such as by molding, co-extrusion or the like, along with their associated substrate layer. The substrate layer and its associated mechanical fastening elements may be formed from substantially the same polymer material, and there need not be a discrete step of attaching the fastening elements to an initially separate substrate layer. For example, the individual hook elements may be integrally formed simultaneously with a hook base-layer by coextruding the base layer and hook elements from substantially the same polymer material.

It should be readily appreciated that the strength of the attachment or other interconnection between the substrate layer and the attached fastening component should be greater than the peak force required to remove the fastener tab **36** from its releasable securement to the appointed landing member of the article.

Procedures

Tensile Testing

For the purposes of the present invention, the properties, such as tensile strength, tensile load and elongation, of a material or component can be determined by ASTM Procedure D 3039 "Tensile Properties of polymer Matrix Composite Materials", with the following specifications and particulars:

- Specimen length (aligned parallel to the applied force): 180 mm;
- Gauge length: 130 mm;
- Specimen width (aligned perpendicular to the applied force): 1 inch (25.4 mm);
- Jaw width (measured parallel to the applied force): ½ inch (12.7 mm);
- Jaw length (measured perpendicular to the applied force): 4 inches (101.6 mm);
- Jaw speed: 500 mm/min.

A suitable testing device is a SINTECH tensile tester (available from Sintech, Inc., a business having offices

located in Research Triangle Park, N.C.), or an equivalent device. The tensile tester is operatively programmed with suitable software, such as TESTWORKS software (available from MTS Systems Corporation, a business having offices located in Edens Prairie, Minn.), or an equivalent software.

Composite, multi-component specimens, such as specimens of a composite-article or a composite retention portion, were stapled at their length-wise ends at locations outside of the test area to prevent slippage of the individual materials within the composite when the composite is mounted in the jaws of the testing device.

The 1-inch (25.4 mm) width of each specimen can be cut with a JDC-1-10 precision cutter (available from Thwing-Albert Instrument Company, a business having offices located in Philadelphia, Pa.), or an equivalent device.

Where a test specimen 80 (single component specimen, or multi-component specimen) is removed from an individual product article, each test specimen is desirably removed from the product article at a location which was centered along both the longitudinal dimension and lateral dimension of the article, as representatively shown in FIG. **6**. The location is selected to avoid the effects of conventional elasticized components that may be present; such as elasticized leg bands, elasticized waistbands, elasticized containment flaps and the like.

Three specimens are tested per sample. The reported value of the particular property being determined for each sample is the arithmetic average of the corresponding data points measured for the three specimens during the testing. All specimens are pulled until the specimen breaks or until the testing apparatus reaches its upper stopper height, which is set at 97 cm.

The following data points were recorded for each test specimen:

Break load (g/in);

Elongation-at-break-load (%);

Peak load (g/in);

Elongation-at-peak-load (%);

Elongation at 100 g load (%);

Load at 15% elongation (gun or N/cm);

Load at 45% elongation (g/in or N/cm);

The peak load is typically determined at the highest-occurring yield point. For this test a yield point is the occurrence of an increase in strain without an increase in stress (zero slope). If, however, when the testing apparatus reaches the 97 cm stopper height, the test sample is supporting a tensile load that is greater than the load at the highest-occurring yield point, then the peak load is the load recorded when the apparatus reaches the 97 cm stopper height.

The break-load is the load applied to the specimen at the breaking point of the specimen. The breaking point is the point during tensile testing at which the load force supported by the specimen exhibits a 60% decrease, as determined by the instantaneous change in load at incremental changes in elongation. At that point the test is ended.

The percent elongation can be determined in accordance with the following formula:

$$\% \text{ elongation} = (L_f - L_o)^* 100/L_o;$$

where: L_o=initial, non-elongated length

L_f=final, elongated length.

Modified Hydrohead For Stretched Materials Testing

To prepare a sample specimen for hydrohead testing, cut the sample to the form of a 6.5 inch×6.5 inch (16.5 cm×16.5 cm) square.

Place the specimen in the SINTECH tester, and center the specimen in the jaws. The jaws are 10 inches (25.4 cm) long (as measured in the direction perpendicular to applied force), and 1 inch (2.54 cm) wide (as measured in the direction parallel to applied force). The gauge length is set to 130 mm (5.1 in), and the jaw speed is set to 500 mm/min. Pull each specimen to the desired elongation. If the sample tears or if visible holes form, the test is ended, and the specimen is considered to be capable of supporting a "zero" hydrohead of water.

If the specimen does not tear and does not form visible holes, clamp the two, opposed, tensioned ends of the stretched specimen in a clamping frame to hold the specimen in its stretched, elongated condition. A suitable clamping frame **90** is representatively shown in FIG. **7**.

The illustrated clamping frame **90** is a three-sided structure which is rectangular in form. The frame can be constructed from any material that is sufficiently strong and rigid to hold the specimen in its appointed stretched and elongated condition. For example, the frame can be constructed from 0.5 inch (1.27 cm) thick LEXAN sheet polymer material (available from General Electric Company, a business having offices located in Pittsfield, Mass.). The frame has a base **91** with a base length **92** measuring 7 inch (17.8 cm) and a base width **93** measuring 0.75 inch (1.9 cm). A frame arm **94** is affixed to extend from each end of the frame base. Each arm **94** has an arm length **95** and an arm width **96** which are sufficient to accommodate the desired clamping mechanism and the stretched specimen. In the shown configuration, for example, the arm length can be 7.25 inch (18.4 cm) and the arm width can be 0.5 inch (1.27 cm). A layer of slip-resistant material **102** is desirably affixed to an appointed mounting surface of each arm **94**. The slip-resistant material can, for example, be a 1/16 inch (1.6 mm) thick, GARLOCK 22 red rubber gasket material, **80** durometer (available from Garlock, a business having offices located in Dayton, Ohio). In the shown arrangement, the clamping mechanism includes a pair of threaded studs **97** is affixed to each clamping arm **94** with a stud spacing **100** that is sufficiently large to allow the placement of the stretched specimen between the two studs on each arm. The shown clamping frame, for example, can have a stud spacing which measures 6 inch (15.2 cm) along the length of each frame arm. A pair of clamping bars **99** are constructed of a material that is sufficiently rigid and strong to hold and maintain the stretched specimen in the frame **90**. In the shown configuration, for example, each clamping bar can be constructed of 0.5 inch (1.27 cm) thick LEXAN sheet material. Each clamping bar is of sufficient size to incorporate a pair of apertures, such as holes or slots, which are suitably sized and spaced-apart to accommodate the placement of a corresponding pair of the threaded studs **97** therethrough. In the shown arrangement, each clamping bar has a bar width **103** of 0.5 inch (1.27 cm) and a bar length **104** of 7 inch (17.8 cm). A layer of the slip-resistant material **102** is desirably affixed to an appointed clamping surface of the clamping bar. A first clamping bar is placed to hold the first tensioned end of the specimen, and a second clamping bar (not shown) is placed to hold the opposite, second tensioned end of the specimen. Threaded fasteners, such as the shown wing nuts **98**, are screwed onto their corresponding threaded studs **97** and tightened to hold and maintain the specimen in the desired stretched condition.

After the tensioned ends of the specimen have been affixed to the clamping frame, remove the specimen from the jaws of the tensile tester. Keeping the specimen secured at the desired elongation, place the specimen in the hydrostatic pressure tester.

Test the hydrostatic pressure resistance of the specimen in accordance with Federal Test method Standard number 191A Method 5514, 1978. A suitable test apparatus is a TEXTEST FX3000 hydrostatic head tester (available from Schmid Corporation located in Spartanburg, S.C. 29301). A small test head with an area of 25.7 cm^2 is used, and the test head can be part number FX3000-26. The specimen tested should be free of tears, holes, folds, wrinkles, or any distortions that would make the specimens abnormal from the rest of the test materials. For the testing, employ water which has been processed through distillation, reverse osmosis, or de-ionization. The water is provided at a temperature of 750±10° F. (24±6° C.), and is introduced at a rate of 61.2 cm/min.

Three specimens of each sample material are tested. The reported value of the particular property being determined for each sample is the arithmetic average of the corresponding data points measured for the three specimens during the testing. The recorded data includes the individual hydrostatic head, test measurements, in centimeters of water. The average values and the standard deviations of the tested specimens can then be calculated.

The following Examples are presented to provide a more detailed understanding of the invention, and are not intended to limit the scope of the invention.

EXAMPLE 1

In Sample 1, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60% (available from Kimberly-Clark Corporation, a business having offices located in Dallas, Tex.). About 9 g/m^2 of strand material composed of KRATON G2760 elastomer (available from Shell Chemical Company located in Houston, Tex.) were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant (available from ICI Americas, Inc.—Emery Group of Wilmington, Del.) at a 0.6 weight percent (wt %) add-on level. The absorbent (retention portion) was an approximately 455 g/m^2 composite which included about 259 g/m^2 of SAICCOR 94 eucalyptus pulp (available from Central National-Gottesman, Inc. located in Purchase, N.Y.); 173 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 23 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company located in Houston, Tex.). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL base N62 surfactant (available from ICI Americas, Inc. of Wilmington, Del.) and GLUCOPON 220UP surfactant (available from Henkel Corporation—Emery Group located in Cincinnati, Ohio). The outer cover (backsheet member) was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m^2 co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation a business having offices located in Dallas, Tex.).

EXAMPLE 2

In Sample 2, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was an approximately 330 g/m^2 composite which included about 126 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 134 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m^2 co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 3

In Sample 3, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion included two layers. Each layer was an approximately 330 g/m^2 composite composed of about 126 g/m^2 softwood pulp with 16 wt % hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 134 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric and a 17.7 g/m^2, co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 4

In Sample 4, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at 0.6 wt % add-on level. The absorbent, retention portion was an approximately 330 g/m^2, air formed composite composed of 37 wt % FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.), and 63 wt % softwood pulp with 16 wt % hardwood

(available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654). The air formed composite was formed onto a 17 g/m^2 cellulosic wetlaid tissue, and this tissue was included as part of the absorbent retention portion during testing. The outer cover, backsheet member included 14 g/m^2 of KRATON G2760, elastomeric resin strands (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive located in Milwaukee, Wis.), between two facings, each facing composed of a 24 g/m^2, point bonded bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 5

In Sample 5, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at 0.6 wt % add-on level. The absorbent, retention portion was an approximately 330 g/m^2, air formed composite composed of 37% FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.), and 63% softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654). The air formed composite was formed onto a 17 g/m^2 cellulosic wetlaid tissue. This tissue was included as part of the absorbent retention portion during testing. The outer cover, backsheet member was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m^2, co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 6

In Sample 6, the topsheet layer was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. The spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 455 g/m^2 composite composed of about 259 g/m^2 of SAICCOR 94 eucalyptus pulp (available from Central National-Gottesman, Inc. located in Purchase, N.Y.); 173 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 23 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m2 co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 7

In Sample 7, the top sheet was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. The spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 330 g/m^2 composite composed of about 126 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and

134 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a is 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m^2 co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 8

In Sample 8, the topsheet layer was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion included two layers. Each layer was an approximately 330 g/m^2 composite composed of about 126 g/m^2 softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 134 g/m^2 of KRATON G2740 styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member is a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m^2 co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 9

In Sample 9, the topsheet layer was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 330 g/m^2, air formed composite composed of 37% FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.), and 63% softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654). The air formed composite was formed onto a 17 g/m^2 cellulosic wetlaid tissue. This tissue was included as part of the absorbent, retention portion during testing. The outer cover, backsheet member about 16 g/m^2 of PEBAX 3533 cast film (available from AtoChem of Philadelphia, Pa.) which was laminated to a 27 g/m^2, biax point-bonded polyethylene polypropylene, side by side bicomponent, spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive, in Milwaukee, Wis.).

EXAMPLE 10

In Sample 10, the topsheet layer was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability

with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 330 g/m^2 air formed composite composed of 37% FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, South Carolina), and 63% softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654). The air formed composite was formed onto a 17 g/m^2 cellulosic wetlaid tissue. This tissue was included as part of the absorbent, retention portion during testing. The outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, each facing composed of a 24 g/m^2 point bonded bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 11

In Sample 11, the topsheet layer was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 455 g/m^2 composite composed of about 259 g/m^2 of SAICCOR 94 eucalyptus pulp (available from Central National-Gottesman, Inc. located in Purchase, N.Y.); 173 g/m^2 of FAVOR SXM 880 superabsorbent particles available from Stockhausen Inc. located in Greensboro, S.C.); and 23 g/m^2 of KRATON G2740 styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive), between two facings, each facing composed of a 24 g/m^2, point bonded bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 12

In Sample 12, the top sheet was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 330 g/m^2 composite composed of about 126 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 134 g/m^2 of KRATON G2740 styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, each facing composed of a 24 g/m^2 point bonded bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 13

In Sample 13, the topsheet layer was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion included two layers. Each layer was an approximately 330 g/m^2 composite composed of about 126 g/m^2 softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 134 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, each facing composed of a 24 g/m^2 point bonded bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 14

In Sample 14, the top sheet was a 17 g/m^2 polypropylene spunbond nonwoven fabric treated for wettability with AHCOVEL N-62 surfactant. This spunbond material is available from Kimberly-Clark located in Dallas, Tex. The absorbent, retention portion was an approximately 330 g/m^2 air formed composite composed of 37% FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.), and 63% softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654). The air formed composite was formed onto a 17 g/m^2 cellulosic wetlaid tissue. This tissue was included as part of the absorbent, retention portion during testing. The outer cover, backsheet member was a stretch thermal laminate composed of a 17 g/m^2 polypropylene spunbond fabric bonded to a 17.7 g/m^2, co-extruded linear-low-density-polyethylene film having a 2.5% by basis weight skin layer of catalloy and ethyl vinyl acetate (available from Kimberly-Clark Corporation located in Dallas, Tex.).

EXAMPLE 15

Sample 15 represents a comparative diaper corresponding to the type manufactured Jul. 20, 1998 by Kimberly-Clark Corporation under the name STEP 3 HUGGIES SUPREME diapers. The sample contained a nonwoven, liquid pervious topsheet layer; a superabsorbent and pulp, airformed absorbent retention portion wrapped in cellulosic tissues; and a liquid impermeable outercover, backsheet member composed of spunbond-meltblown-spunbond (SMS) composite, nonwoven fabric laminated to a polymer film.

EXAMPLE 16

Sample 16 represents a comparative diaper corresponding to the type manufactured May 19, 1998 by Kimberly-Clark Corporation under the name STEP 3 HUGGIES ULTRATRIM diapers. The sample contained a nonwoven, liquid

pervious topsheet layer; a superabsorbent and pulp, airformed absorbent retention portion wrapped in cellulosic tissues; and a liquid impermeable outercover, backsheet member composed of thermally bonded spunbond nonwoven fabric laminated to a polymer film.

EXAMPLE 17

Sample 17 represents a comparative diaper corresponding to the type manufactured Mar. 2, 1998 by Proctor and Gamble Company under the name PAMPERS BABY DRY diapers, size 3.

EXAMPLE 18

Sample 18 represents a comparative diaper corresponding to the type manufactured Apr. 19, 1998 by Proctor and Gamble Company under the name PAMPERS PREMIUM diapers, size 3.

EXAMPLE 19

Sample 19 represents a comparative training pant corresponding to the type manufactured Oct. 23, 1997 by Kimberly-Clark Corporation under the name PULL-UPS medium Girl training pants. The example contained a nonwoven, liquid pervious topsheet layer; a superabsorbent and pulp, airformed absorbent retention portion wrapped in cellulosic tissues; and a liquid impermeable outer cover, backsheet member composed of a polymer film adhesively laminated to a nonwoven spunbond fabric.

EXAMPLE 20

Sample 20 represents a comparative training pant corresponding to the type manufactured Jun. 10, 1998 by Kimberly-Clark Corporation under the name PULL-UPS medium Boy training pants. The example contained a nonwoven, liquid pervious topsheet layer; a superabsorbent and pulp, airformed absorbent retention portion wrapped in cellulosic tissues; and a liquid impermeable outer cover, backsheet member composed of a polymer film adhesive laminated to a nonwoven spunbond fabric.

EXAMPLE 21

Sample 21 represents a comparative training pant corresponding to the type manufactured Jul. 25, 1997 by SCA Molnlycke under the name UP & GO LIBERO for girls.

EXAMPLE 22

Sample 22 represents a comparative training pant corresponding to the type manufactured Jun. 4, 1997 by SCA Molnlycke under the name UP & GO LIBERO for boys.

The properties of the samples from Examples 1 through 22 are summarized in the following TABLE 1. Samples 1 through 22 did not include configurations which met the requirements of the invention.

TABLE 1

Sample No.	Article Elongation at Peak Load %	Article Elongation at 100 g %
1	26.90	1.62
1	29.90	2.37
1	32.40	2.87

TABLE 1-continued

Sample No.	Article Elongation at Peak Load %	Article Elongation at 100 g %
1 -Average	29.73	2.29
2	28.40	2.53
2	28.30	2.40
2	30.00	1.74
2 -Average	28.90	2.22
3	29.00	2.59
3	31.10	2.83
3	31.70	4.61
3 -Average	30.60	3.34
4	31.40	3.83
4	32.90	3.67
4	27.80	2.18
4 -Average	30.70	3.23
5	30.50	1.71
5	29.30	1.02
5	29.40	1.67
5 -Average	29.73	1.46
6	27.70	1.51
6	30.40	1.13
6	23.70	1.08
6 -Average	27.27	1.24
7	29.80	2.56
7	30.60	1.37
7	26.60	2.69
7 -Average	29.00	2.21
8	29.20	1.57
8	25.60	1.48
8	24.00	0.91
8 -Average	26.27	1.32
9	30.70	1.18
9	28.80	1.68
9	29.70	1.59
9 -Average	29.73	1.48
10	29.80	0.84
10	25.90	0.75
10	27.70	0.80
10 -Average	27.80	0.80
11	33.10	1.90
11	30.30	1.43
11	30.30	2.10
11-Average	31.23	1.81
12	29.20	****
12	30.20	1.22
12	35.60	1.66
12 -Average	31.67	1.44
13	44.80	1.01
13	27.50	1.74
13	45.10	1.88
13 -Average	39.13	1.54
14	23.30	1.22
14	25.10	0.84
14	28.40	0.87
14 -Average	25.60	0.98
15	24.20	2.86
15	28.70	2.20
15	26.70	2.61
15 -Average	26.53	2.56
16	27.70	2.03
16	32.90	3.52
16	19.30	1.78
16 -Average	26.63	2.44
17	16.40	2.12
17	14.90	2.29
17	42.30	2.89
17 -Average	24.53	2.43
18	43.30	1.75
18	29.20	2.01
18	26.80	1.63
18 -Average	33.10	1.80
19	34.70	4.52
19	29.80	3.23
19	36.10	3.21
19 -Average	33.53	3.65
20	31.80	2.22

TABLE 1-continued

Sample No.	Article Elongation at Peak Load %	Article Elongation at 100 g %
20	32.10	2.44
20	31.90	4.51
20 -Average	31.93	3.06
21	33.80	2.97
21	47.20	1.43
21	40.50	2.11
21 -Average	40.50	2.17
22	37.40	1.80
22	27.50	3.61
22	45.60	1.68
22 -Average	36.83	2.37

***Specimen broke prior to reaching 100 g

Each of the following samples was composed of a stretchable, absorbent retention portion which was sandwiched and held between a stretchable, liquid-permeable topsheet layer, and a stretchable, substantially liquid-impermeable outer cover, backsheet member.

EXAMPLE 23

In Sample 23, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web. The web had a basis weight of about 12 g/m^2, and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer (available from Shell Chemical Company located in Houston, Tex.) were adhered to the necked spunbond material at a distribution of about eight strands per inch (2.54 cm). The fabric was surface treated with an AHCOVEL surfactant wettability package from ICI Americas, Inc. of Wilmington, Del. at a 0.6 wt % add-on level. The absorbent, retention portion was a 555 g/m^2, homogeneous composite composed of about 252 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 155 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company located in Houston, Tex.). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 surfactant (available from ICI Americas, Inc. of Wilmington, Del.) and GLUCOPON 220UP surfactant (available from Henkel Corporation—Emery Group located in Cincinnati, Ohio). The outer cover, backsheet member was composed of about 16 g/m^2 of a PEBAX 3533 cast elastomer film (available from AtoChem of Philadelphia, Pa.) which was laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded, polyethylene-polypropylene, side-by-side bicomponent spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive located in Milwaukee, Wis.).

EXAMPLE 24

In Sample 24, the top sheet was composed of a 33.9 g/m^2, side-by-side polypropylene flexible polyolefin bicomponent, point bonded, spunbond nonwoven fibrous web. The fabric was surface treated with a wettability package, such as the package available from ICI Americas located in Wilmington, Del. under the tradename AHCOVEL. The absorbent, retention portion was a 555 g/m^2 homogeneous composite composed of about 252 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 155 g/m^2 of a KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was composed of about 16 g/m^2 of PEBAX 3533 cast film (available from AtoChem of Philadelphia, Pa.) which was laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded polyethylene-polypropylene, side-by-side bicomponent, spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive, in Milwaukee, Wis.).

EXAMPLE 25

In Sample 25, the top sheet was a nonwoven, spunbond polypropylene fabric composed of approximately 2 to 3 denier fibers formed into a web, which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material with a distribution of approximately eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was an approximately 485 g/m^2 composite composed of about 252 g/m^2 softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 85 g/m^2 of a KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was composed of about 16 g/m^2 of PEBAX 3533 cast film (available from AtoChem of Philadelphia, Pa.) which was laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded polyethylene-polypropylene, side-by-side bicomponent spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive located in Milwaukee, Wis.).

EXAMPLE 26

In Sample 26, the top sheet was composed of a 33.9 g/m^2, side-by-side polypropylene flexible polyolefin bicomponent, point bonded, spunbond nonwoven fibrous web. The fabric was surface treated with a wettability package such as that available from ICI Americas located in Wilmington, Del. under the tradename AHCOVEL. The absorbent, retention portion was a 485 g/m^2 composite composed of about 252 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles; and 85 g/m^2 of a KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was composed of about 16 g/m^2 of a PEBAX 3533 cast film

(available from AtoChem of Philadelphia, Pa.) which was laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded polyethylene-polypropylene, side-by-side bicomponent, spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive).

EXAMPLE 27

In Sample 27, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web, which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of KRATON G2760, elastic strand material were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with an AHCOVEL surfactant wettability package available from ICI Americas, Inc. of Wilmington, Del. at a 0.6 wt % add-on level. The absorbent, retention portion was a 555 g/m^2 homogeneous composite composed of about 252 g/m^2 softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 155 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, with each facing composed of a 24 g/m^2, point bonded bicomponent spunbond fabric. The strands were distributed with 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 28

In Sample 28, the top sheet was composed of a 33.9 g/m^2, side-by-side polypropylene flexible polyolefin bicomponent, point bonded, spunbond nonwoven fibrous web. The fabric was surface treated with a wettability package such as that available from ICI Americas under the tradename AHCOVEL. The absorbent, retention portion was a 555 g/m^2 homogeneous composite composed of about 252 g/m^2 softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc.); and 155 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin(available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member was composed of 14 g/m^2 of KRATON G2760 elastomeric resin strands laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, with each facing composed of a 24 g/m^2, point bonded, bicomponent spunbond fabric. The elastomeric resin strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 29

In Sample 29, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of approximately 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 485 g/m^2 composite composed of about 252 g/m^2 softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles available from Stockhausen Inc.); and 85 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member was composed of 14 g/m^2 of KRATON G2760, elastomeric resin strands which were laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, with each facing composed of a 24 g/m^2, point bonded, bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 30

In Sample 30, the top sheet was composed of a 33.9 g/m^2, side-by-side polypropylene flexible polyolefin bicomponent, point bonded, spunbond nonwoven fibrous web. The fabric was surface treated with a wettability package such as that available from ICI Americas under the tradename AHCOVEL. The absorbent, retention portion was a 485 g/m^2 composite composed of about 252 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 148 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc.); and 85 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) which were laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings with each facing composed of a 24 g/m^2, point bonded, bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 31

In Sample 31, the top sheet was a nonwoven, spunbond polypropylene fabric composed of approximately 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of KRATON G2760, strand material were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with ACHOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 455 g/m^2 composite composed of about 259 g/m^2 of SAICCOR 94 eucalyptus pulp (available from Central National-Gottesman, Inc. located in Purchase, N.Y.); 173 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc.); and 23 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin

(available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was composed of about 16 g/m^2 of PEBAX 3533 cast film (available from AtoChem of Philadelphia, Pa.) which was laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded, polyethylene-polypropylene, side-by-side bicomponent, spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive located in Milwaukee, Wis.).

EXAMPLE 32

In Sample 32, the top sheet was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 455 g/m^2 composite composed of about 259 g/m^2 of SAICCOR 94 eucalyptus pulp (available from Central National-Gottesman, Inc. located in Purchase, N.Y.); 173 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 23 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760, elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, with each facing composed of a 24 g/m^2, point bonded, bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 33

In Sample 33, the top sheet was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 330 g/m^2 composite composed of about 126 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc.); and 134 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member was composed of about 16 g/m^2 of PEBAX 3533 cast film (available from AtoChem of Philadelphia, Pa.) which was laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded, polyethylene-polypropylene, side-by-side bicomponent, spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive, in Milwaukee, Wis.).

EXAMPLE 34

In Sample 34, the topsheet layer was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web, which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond fabric and was distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 330 g/m^2 composite composed of about 126 g/m^2 of softwood pulp with 16% hardwood (available from US Alliance Forest Products located in Coosa River, Ala. under the designation CR 1654); 70 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc. located in Greensboro, S.C.); and 134 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, with each facing composed of a 24 g/m^2, point bonded bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

EXAMPLE 35

In Sample 35, the top sheet was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 475 g/m^2 composite composed of about 254 g/m^2 of debonded softwood pulp (available from Weyerhauser, located in Federal Way, Washington, under the designation NB 405); 151 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc.); and 70 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The outer cover, backsheet member included about 16 g/m^2 of PEBAX 3533 cast film (available from AtoChem of Philadelphia, Pa.) which is laminated to a 0.8 osy (27.1 g/m^2) biax point-bonded, polyethylene-polypropylene, side-by-side bicomponent, spunbond fibrous web with 2 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive located in Milwaukee, Wis.).

EXAMPLE 36

In Sample 36, the top sheet was a nonwoven, spunbond polypropylene fabric composed of about 2 to 3 denier fibers formed into a web which had a basis weight of about 12 g/m^2 and was necked approximately 60%. About 9 g/m^2 of strand material composed of KRATON G2760 elastomer were adhered to the necked spunbond material and distributed with about eight strands per inch (2.54 cm). The fabric was surface treated with AHCOVEL surfactant at a 0.6 wt % add-on level. The absorbent, retention portion was a 475

g/m^2 composite composed of about 254 g/m^2 of NB 405, debonded softwood pulp (available from Weyerhauser); 151 g/m^2 of FAVOR SXM 880 superabsorbent particles (available from Stockhausen Inc.); and 70 g/m^2 of KRATON G2740, styrene-butadiene block copolymer elastomeric resin (available from Shell Chemical Company). The absorbent was surface treated with a 3% solution of a 3:1 ratio (by active weight) of AHCOVEL N62 and GLUCOPON 220UP surfactants. The liquid impermeable outer cover, backsheet member included 14 g/m^2 of strands composed of KRATON G2760 elastomeric resin (available from Shell Chemical Company) which were laminated with 0.3 g/m^2 of H2525A adhesive (available from AtoFindley Adhesive) between two facings, with each facing composed of a 24 g/m^2, point bonded, bicomponent spunbond fabric. The strands were distributed with about 12 strands per inch (2.54 cm) of sample width.

The properties of the samples from Examples 23 through 36 are summarized in the following TABLES 2 and 3. Samples 23 through 36 include configurations which are representative of the invention.

TABLE 2

	Elongation at 100 g/in tensile force						
Sample	Article	Retention portion to Article	Backsheet to Article	Retention portion to Backsheet	Article Elongation at Peak Load	Article Force at 45% Elongation	
No.	%	quotient	quotient	quotient	%	N/cm	gm/in
23	4.10	1.71	3.41	0.50	233.60	2.25	583.56
23	5.40	0.88	13.52	0.07	236.00	2.46	638.45
23	3.50	1.67	16.13	0.10	203.80	2.77	718.65
23	4.33	1.42	11.02	0.22	224.47	2.50	646.89
Average							
24	4.40	1.59	3.18	0.50	147.30	2.93	759.86
24	3.80	1.26	19.21	0.07	143.30	2.75	713.37
24	4.20	1.39	13.44	0.10	165.50	2.69	696.60
24	4.13	1.41	11.94	0.22	152.03	2.79	723.28
Average							
25	4.60	1.79	3.04	0.59	225.50	2.15	555.90
25	7.10	0.85	10.28	0.08	161.90	1.76	455.09
25	6.70	0.91	8.43	0.11	246.70	1.85	480.53
25	6.13	1.18	7.25	0.26	211.37	1.92	497.17
Average							
26	6.50	1.27	2.15	0.59	175.50	2.01	520.08
26	4.60	1.30	15.87	0.08	147.10	2.39	618.52
26	6.80	0.90	8.30	0.11	173.00	2.09	540.69
26	5.97	1.16	8.77	0.26	165.30	2.16	559.76
Average							
27	4.80	1.46	16.91	0.09	232.00	2.12	548.42
27	3.50	1.36	21.35	0.06	241.20	2.27	589.28
27	4.00	1.46	17.28	0.08	246.80	2.08	537.58
27	4.10	1.43	18.51	0.08	240.00	2.16	558.43
Average							
28	4.50	1.56	18.04	0.09	424.20	2.68	693.59
28	4.40	1.08	16.98	0.06	377.70	2.61	675.97
28	4.00	1.46	17.28	0.08	402.30	2.90	751.50
28	4.30	1.37	17.43	0.08	401.40	2.73	707.02
Average							
29	5.20	1.58	15.61	0.10	245.10	1.50	388.94
29	8.00	0.75	9.34	0.08	228.30	1.39	360.37
29	6.70	0.91	10.31	0.09	245.00	1.57	407.78
29	6.63	1.08	11.75	0.09	239.47	1.49	385.70
Average							
30	6.40	1.29	12.68	0.10	424.30	2.13	552.05
30	7.30	0.82	10.23	0.08	143.00	1.88	487.70
30	6.30	0.97	10.97	0.09	166.20	2.03	526.08
30	6.67	1.03	11.30	0.09	244.50	2.01	521.94
Average							
31	4.30	1.31	3.25	0.40	226.00	1.26	327.51
31	4.00	1.26	18.25	0.07	221.40	1.52	393.98
31	3.50	1.00	16.13	0.06	164.10	1.25	323.60
31	3.93	1.19	12.54	0.18	203.83	1.34	348.36
Average							
32	3.60	1.56	22.55	0.07	198.10	1.31	339.67
32	4.50	1.12	16.60	0.07	189.50	1.08	279.35
32	4.20	0.84	16.45	0.05	180.90	1.59	412.91
32	4.10	1.17	18.53	0.06	189.50	1.33	343.98
Average							
33	4.00	4.24	3.50	1.21	212.20	2.06	532.39
33	3.20	2.58	22.81	0.11	249.10	2.31	598.66
33	4.30	1.03	13.13	0.08	255.70	2.15	558.21
33	3.83	2.62	13.14	0.47	239.00	2.17	563.09

TABLE 2-continued

Sample	Elongation at 100 g/in tensile force: Article	Retention portion to Article	Backsheet to Article	Retention portion to Backsheet	Article Elongation at Peak Load	Article Force at 45% Elongation	
No.	%	quotient	quotient	quotient	%	N/cm	gm/in
Average							
34	9.30	1.82	8.73	0.21	233.20	1.48	384.33
34	8.60	0.96	8.69	0.11	230.80	1.62	418.93
34	8.20	0.54	8.43	0.06	230.00	1.61	415.93
34	8.70	1.11	8.61	0.13	231.33	1.57	406.40
Average							
35	5.30	2.00	2.64	0.76	244.30	1.58	409.62
35	7.00	1.68	10.43	0.16	236.00	1.29	332.96
35	6.20	2.04	9.10	0.22	224.60	1.42	368.06
35	6.17	1.91	7.39	0.38	234.97	1.43	370.21
Average							
36	7.70	1.38	10.54	0.13	236.50	1.07	278.16
36	8.50	1.38	8.79	0.16	237.10	0.96	247.50
36	8.80	1.44	7.85	0.18	246.50	1.13	292.44
36	8.33	1.40	9.06	0.16	240.03	1.05	272.70
Average							

TABLE 3

Sample	Tensile force at 15% Elongation: Article		Retention portion to article	Backsheet to article	Retention portion to backsheet
No.	N/cm	gram/in	quotient	quotient	quotient
23	1.43	371.20	0.64	0.28	2.28
23	1.26	325.30	0.97	0.09	10.75
23	1.84	477.90	0.65	0.08	8.37
23	1.51	391.47	0.75	0.15	7.13
Average					
24	1.41	364.00	0.66	0.29	2.28
24	1.51	391.30	0.81	0.08	10.75
24	1.74	450.20	0.69	0.08	8.37
24	1.55	401.83	0.72	0.15	7.13
Average					
25	1.23	318.40	0.59	0.33	1.80
25	0.88	227.70	1.13	0.13	8.77
25	0.90	234.10	0.94	0.16	5.94
25	1.00	260.07	0.89	0.21	5.50
Average					
26	0.92	238.40	0.79	0.44	1.80
26	1.25	323.80	0.80	0.09	8.77
26	0.93	242.10	0.91	0.15	5.94
26	1.03	268.10	0.83	0.23	5.50
Average					
27	1.25	323.30	0.74	0.13	5.88
27	1.59	413.20	0.76	0.09	8.16
27	1.30	336.90	0.92	0.12	7.69
27	1.38	357.80	0.81	0.11	7.24
Average					
28	1.43	369.80	0.65	0.11	5.88
28	1.40	362.20	0.87	0.11	8.16
28	1.69	436.60	0.71	0.09	7.69
28	1.50	389.53	0.74	0.10	7.24
Average					
29	1.03	266.00	0.71	0.15	4.64
29	0.72	185.60	1.39	0.21	6.66
29	0.85	220.60	1.00	0.18	5.46
29	0.86	224.07	1.03	0.18	5.59
Average					
30	1.04	269.80	0.70	0.15	4.64
30	0.92	237.20	1.09	0.16	6.66
30	1.06	275.80	0.80	0.15	5.46
30	1.01	260.93	0.86	0.15	5.59

TABLE 3-continued

Sample	Tensile force at 15% Elongation: Article		Retention portion to article	Backsheet to article	Retention portion to backsheet
No.	N/cm	gram/in	quotient	quotient	quotient
Average					
31	1.48	382.80	0.76	0.27	2.78
31	1.63	422.50	0.67	0.07	9.56
31	1.48	382.30	0.81	0.10	8.39
31	1.53	395.87	0.75	0.15	6.91
Average					
32	1.48	384.60	0.76	0.11	7.18
32	1.22	316.90	0.89	0.12	7.26
32	1.63	422.90	0.73	0.10	7.70
32	1.45	374.80	0.79	0.11	7.38
Average					
33	1.32	341.90	0.25	0.31	0.83
33	1.48	383.20	0.44	0.08	5.71
33	1.32	341.00	0.78	0.11	7.19
33	1.37	355.37	0.49	0.16	4.57
Average					
34	0.63	163.60	0.53	0.25	2.14
34	0.70	182.40	0.92	0.21	4.33
34	0.71	183.60	1.45	0.22	6.60
34	0.68	176.53	0.97	0.23	4.36
Average					
35	1.04	268.40	0.51	0.39	1.31
35	0.81	211.00	0.60	0.14	4.28
35	0.91	234.50	0.51	0.16	3.21
35	0.92	237.97	0.54	0.23	2.93
Average					
36	0.70	180.60	0.76	0.23	3.38
36	0.65	169.20	0.74	0.23	3.25
36	0.67	172.90	0.69	0.23	2.95
36	0.67	174.23	0.73	0.23	3.19
Average					

Having described the invention in rather full detail, it will be readily apparent that various changes and modifications can be made without departing from the spirit of the invention. All of such changes and modifications are contemplated as being within the scope of the invention as defined by the subjoined claims.

We claim:

1. An absorbent article having a longitudinal direction, a transverse direction, a front portion, a back portion, and an intermediate portion interconnecting said front and back portions, said article comprising:

a substantially elastomerically stretchable backsheet member;

a liquid-permeable topsheet layer; and

a substantially elastomedcally stretchable retention portion sandwiched between said backsheet member and said topsheet layer, said retention portion having an incremental absorbent capacity of at least about 5 grams of absorbed liquid per gram of absorbent; wherein

said absorbent article provides a composite article elongation-at-peak-load value which is at least about 50%; and

said retention portion provides a retention portion elongation-at-peak-load value of at least about 10%.

2. An article as recited in claim 1, wherein said topsheet layer has a topsheet elongation-at-peak-load value which is at least about 50%.

3. An article as recited in claim 1, wherein said backsheet member is substantially liquid-impermeable when stretched to a backsheet elongation of 45%.

4. An article as recited in claim 1, wherein said retention portion provides a retention portion elongation-at-break value of at least about 50%.

5. An article as recited in claim 1, wherein said article provides an article load value of not more than about 750 g/inch at an article elongation of 45%.

6. An article as recited in claim 1, wherein said backsheet member provides a backsheet elongation-at-peak-load value of at least about 75%.

7. An article as recited in claim 1, wherein said topsheet layer provides a topsheet elongation-at-peak-load value of at least about 75%.

8. An article as recited in claim 1, wherein a quotient of an elongation value said retention portion divided by an elongation value of said composite article is at least about 1.01, where each such elongation value is determined at a loading of 100 g/inch.

9. An article as recited in claim 1, wherein said retention portion has an incremental absorbent capacity of at least about 8 grams of absorbed liquid per gram of absorbent.

10. An article as recited in claim 1, wherein said retention portion has a total absorbent capacity of at least about 10 grams of absorbed liquid per gram of absorbent.

11. An article as recited in claim 1, wherein said retention portion has a total absorbent capacity of at least about 50 grams of absorbed liquid.

12. An article as recited in claim 1, wherein said retention portion has a total absorbent capacity of at least about 100 grams of absorbed liquid.

13. An article as recited in claim 1, wherein said retention portion has a total absorbent capacity of at least about 200 grams of absorbed liquid.

14. An article as recited in claim 1, wherein said retention portion provides a retention portion elongation-at-peak-load value of at least about 20%.

15. An article as recited in claim 1, wherein said retention portion provides a retention portion elongation-at-peak-load value of at least about 40%.

16. An absorbent having a longitudinal direction, a transverse direction, a front portion, a back portion, and an intermediate portion interconnecting said front and back portions, said article comprising:

a substantially elastomerically stretchable backsheet member;

a liquid-permeable topsheet layer; and

a substantially elastomerically stretchable retention portion sandwiched between said backsheet member and said topsheet layer; wherein

said absorbent article provides a composite article elongation-at-peak-load value which is at least about 50%;

said retention portion has an incremental absorbent capacity of least about 5 g/g, and a total absorbent capacity of at least about 50 g; and

said retention portion includes a matrix having at least about 10 wt % superabsorbent material, and at least about 2 wt % elastomeric fibers.

17. An article as recited in claim 16, wherein said retention portion includes an elastomeric coform material.

18. An article as recited in claim 17, wherein said elastomeric coform material has an overall coform basis weight of at least about 50 g/m^2.

19. An article as recited in claim 16, wherein said elastomeric fibers are provided at a basis weight of at least about 1 g/m^2.

20. An article as recited in claim 19, wherein said elastomeric fibers are provided at a basis weight of not more than about 300 g/m^2.

21. An article as recited in claim 19, wherein said retention portion includes not more than about 60 wt % elastomeric fiber.

22. An article as recited in claim 16, wherein said superabsorbent material is provided at a basis weight of at least about 5 g/m^2.

23. An article as recited in claim 22, wherein said retention portion includes not more than about 65 wt % superabsorbent material.

24. An article as recited in claim 16, wherein said retention portion includes a matrix further having at least about 10 wt % absorbent fiber.

25. An article as recited in claim 24, wherein said absorbent fibers are provided at a basis weight of at least about 10 g/m^2.

26. An absorbent article having a longitudinal direction, a transverse direction, a front portion, a back portion, and an intermediate portion interconnecting said front and back portions, said article comprising:

a substantially elastomerically stretchable backsheet member;

a liquid-permeable topsheet layer; and

a substantially elastomerically stretchable retention portion sandwiched between said backsheet member and said topsheet layer; wherein

said absorbent article provides a composite article elongation-at-peak-load value which is at least about 50%;

said backsheet member has a backsheet elongation-at-peak-load value which is at least about 50%

a quotient of an elongation value of said backsheet member divided by an elongation value said composite article is at least about 1.1, where each such elongation value is determined at a loading of 100 g/inch.

27. An absorbent article as recited in claim 26, wherein the quotient of said elongation value of said backsheet

member divided by said elongation value of said composite article is at least about 1.2.

28. An absorbent article as recited in claim 26, wherein the quotient of said elongation value of said backsheet member divided by said elongation value of said composite article is at least about 1.3.

* * * * *

US006616648B2

(12) **United States Patent**
Hermansson et al.

(10) **Patent No.: US 6,616,648 B2**
(45) **Date of Patent: Sep. 9, 2003**

(54) **ABSORBENT ARTICLE HAVING V-SHAPED ELASTIC ATTACHED TO BACKSHEET**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/820,686**

(22) Filed: **Mar. 30, 2001**

(65) **Prior Publication Data**

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Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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(52) **U.S. Cl.** **604/385.27**; 604/385.23; 604/385.3; 604/385.22; 604/385.21; 604/385.2; 604/385.24; 604/385.27; 604/385.31; 604/380; 604/379; 604/385.01

(58) **Field of Search** 604/385.26, 385.22, 604/385.24, 385.27, 385.31, 380, 379, 385.01

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Primary Examiner—John J. Calvert
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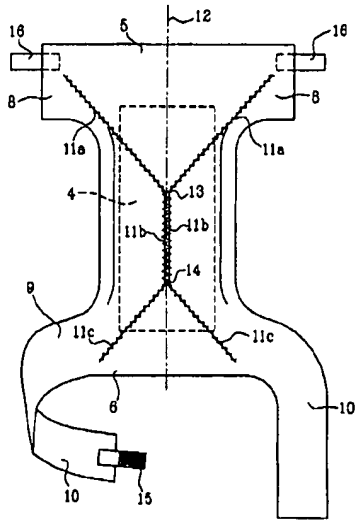
(57) **ABSTRACT**

Absorbent article such as a diaper and an incontinence guard comprising a liquid permeable topsheet (**2**), a liquid impermeable backsheet (**3**) and an absorbent body (**4**) enclosed therebetween, said article having a front portion (**5**), a rear portion (**6**) and a crotch portion (**7**), therebetween, whereby the front and rear portion exhibits side flaps (**8, 9**), which are intended to attach the article to a pantlike shape around the waist of the user. The article has at least one pre-stressed elastic means (**11***a*) and at least attached to the back sheet, that said first elastic means (**11***a*) is brought in an essentially V-shaped pattern having the peak of the pattern located to a first point (**13**) being essentially located on a imagined longitudinal center line (**12**) in said crotch portion (**7**) and that the V-shaped elastic means (**11***a*) diverge in the direction from said longitudinal center line (**12**) toward the front portion (**5**).

15 Claims, 3 Drawing Sheets



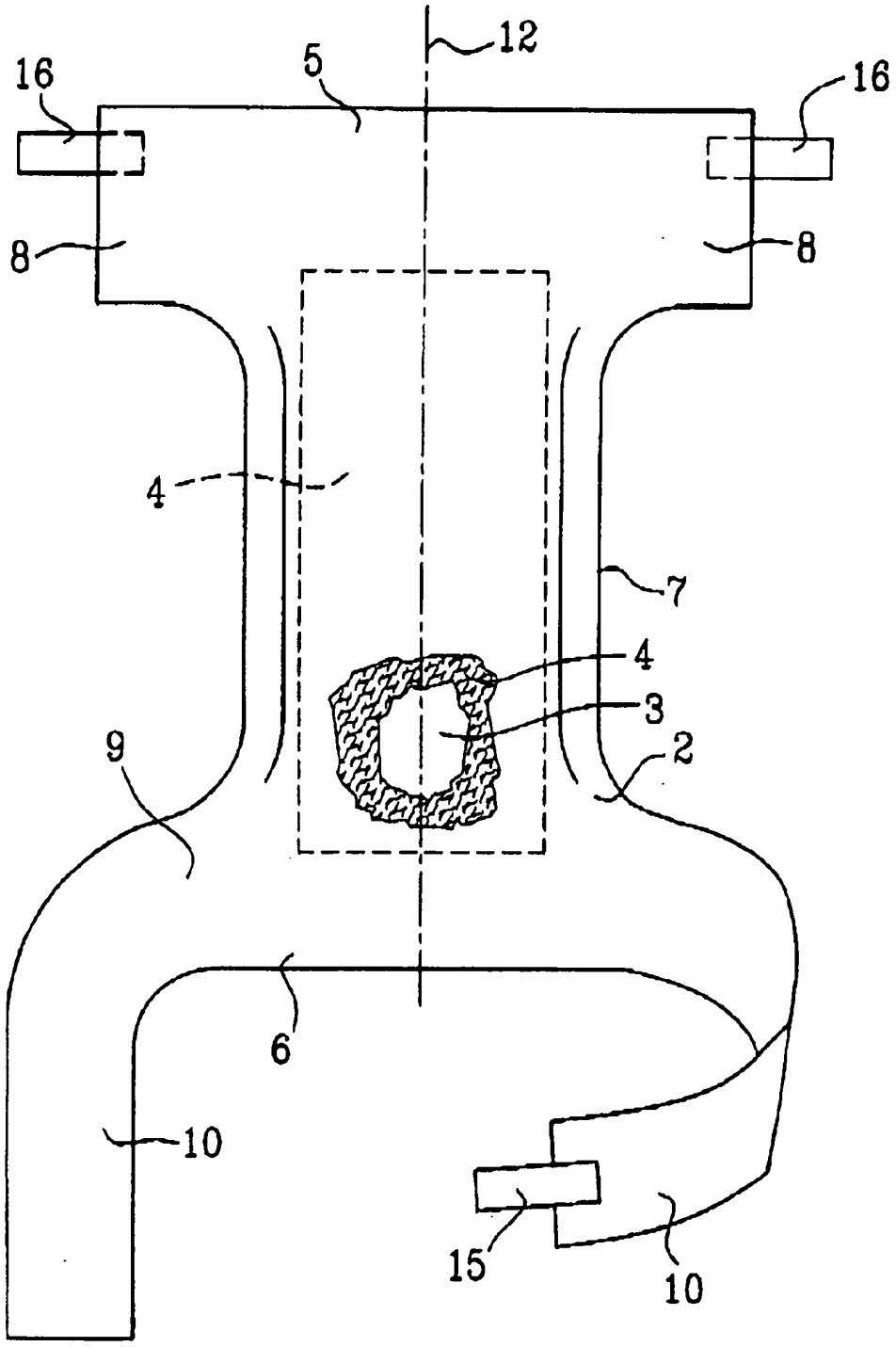


FIG. 1

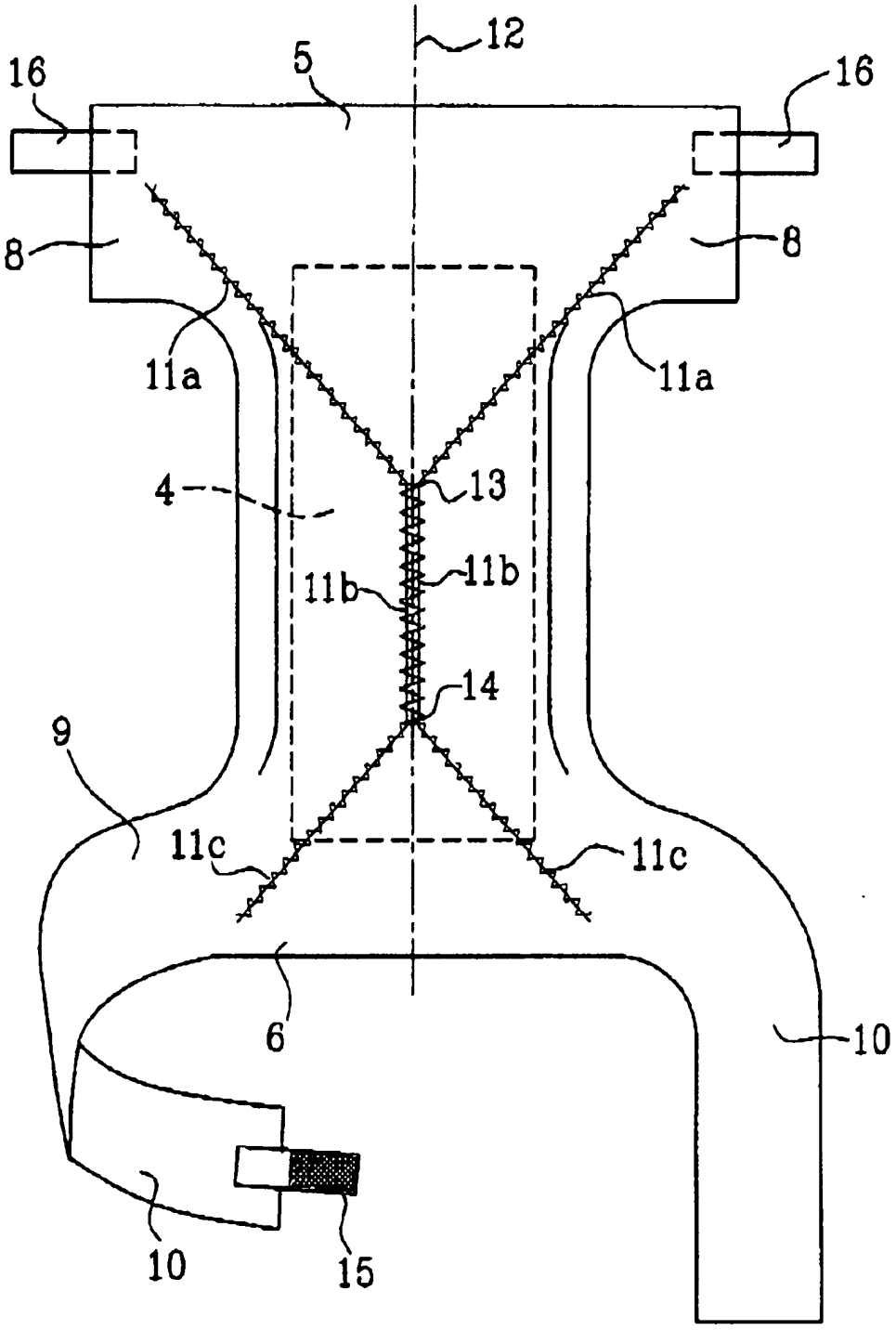


FIG.2

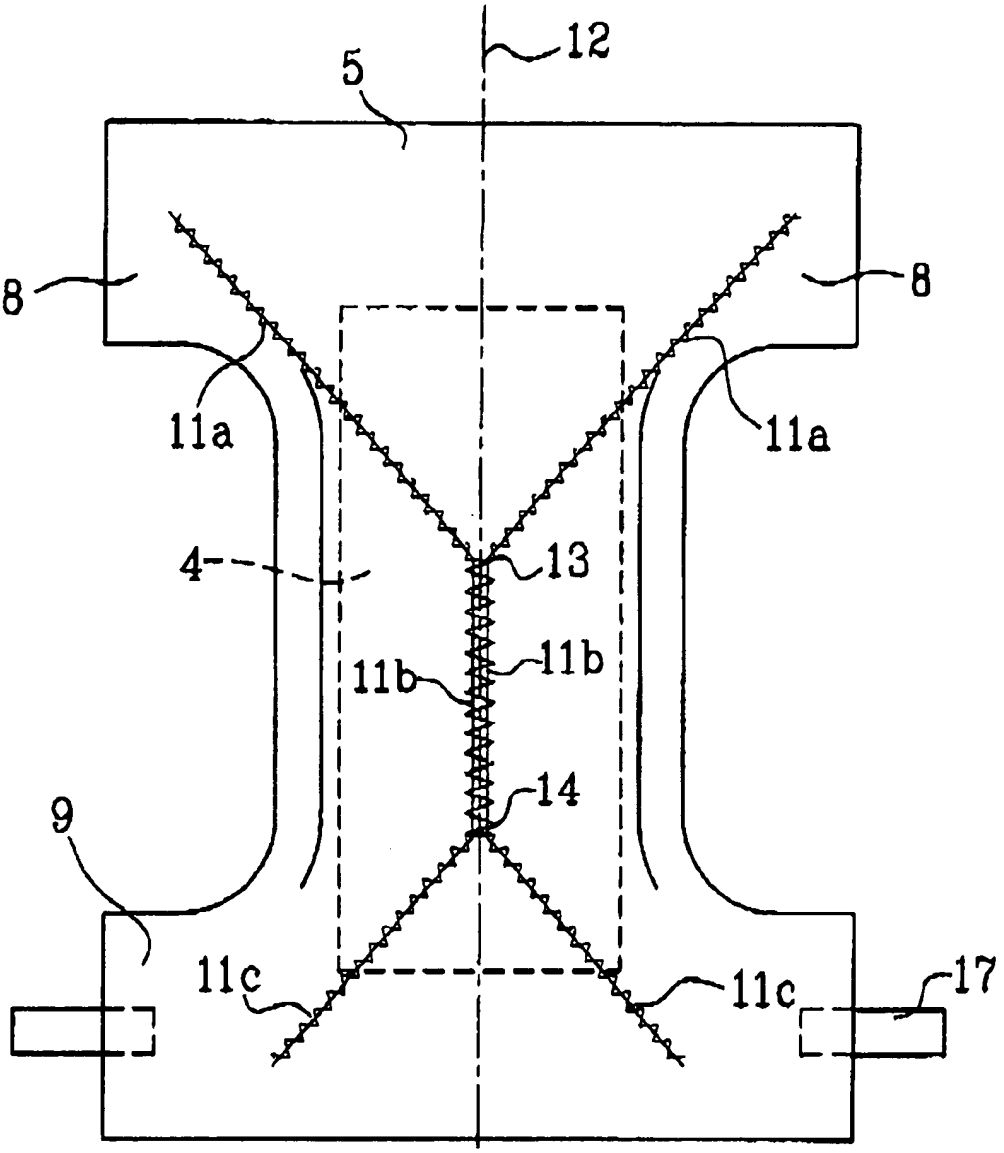


FIG.3

ABSORBENT ARTICLE HAVING V-SHAPED ELASTIC ATTACHED TO BACKSHEET

This application claims priority under 35 U.S.C. §§119 and/or 365 to Swedish Application No. 0001177-5 filed in Sweden on Mar, 31, 2000 and to U.S. Provisional Application No. 60/201,315, filed on May 2, 2000, the entire contents of which are hereby incorporated by reference.

TECHNICAL FIELD

The present invention relates to an absorbent article such as a diaper and an incontinence guard comprising a liquid permeable topsheet, a liquid impermeable backsheet and an absorbent body enclosed therebetween, said article having a front portion, a rear portion and a crotch portion therebetween, whereby the front and rear portion exhibits side flaps, which are intended to attach the article together to a pantlike shape around the waist of the user. The article comprises at least one elastic means, which is preferably arranged between the absorption body and the backsheet.

THE BACKGROUND OF THE INVENTION

Diapers and incontinence guards for incontinent adults usually exhibit a garment portion holding an absorption body in place against the user's body and attachment means, which hold the garment portion in place also when the user is moving.

It is previously known that diapers and incontinence guards for adults are formed, as to form a "basin" in the crotch portion, which can receive the liquid before it is being sucked into the absorbing material. This diaper may be experienced as being unwieldy and uncomfortable for certain persons depending on the body construction. Today's absorption materials usually have such high and fast absorbing properties that the basin construction not always is necessary, since the liquid penetrates the absorbent body at such speed that leakage is avoided. It would therefore be desirable to provide a diaper and an incontinence guard for adults having an improved fit giving the best possible comfort to the wearer and also seals properly against the groins to prevent possible leakage.

U.S. Pat. No 4,229,835 discloses a panty for sport activities which is provided with an Y-shaped elastic support ribbon at the rear portion of the panty. This gives a lifting support for the bottom, but does not lead to an increased sealing against the groins. The object of this panty is to provide an increased comfort and protect the crotch region of the wearer at activities which require long term sitting, for example at a bicycle saddle, a riding saddle or the like. Therefore, an absorbent article is not the issue, whose task is to absorb body liquids and where the leakage security is one of the main objects.

WO 90/04374 discloses a diaper having central located elastic, for the adoption to the body. However, the elastic is not connected to the end portions of the diaper whereby an effective sealing against the groins not is obtained.

EP 729 329 discloses a leg elastic, which is directly connected to a waist belt for a better fit. However, the localisation of the elastic means provides a totally different fit than the present invention.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a diaper or an incontinence guard for adults which has an improved fit which gives the best possible comfort for the wearer and also seals properly against the groins to prevent possible leakage.

This object is being solved through the features, which are given in the characterising portion of claim **1**. Further features are evident from the depending claims and in the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will in the following be closer described with reference to a couple of embodiments shown on the enclosed drawings.

FIG. **1** shows schematically a view in perspective from above of a diaper or incontinence guard according to the invention.

FIG. **2** shows the diaper in FIG. **1** from above designed as a belt diaper.

FIG. **3** shows the diaper according to the invention from above designed as a usually so-called all-in-one diaper.

DETAILED DESCRIPTION OF THE INVENTION

The drawings show a couple of embodiments of diapers or incontinence guards **1**, comprising a liquid impermeable back sheet **2**, a liquid permeable topsheet **3** and an absorbent body **4** enclosed therebetween. The liquid permeable topsheet **3** may consist of a non-woven material, e.g. a spunbond material from continuos filaments, a meltblown material or a bonded carded fibrous web. The liquid impermeable backsheet **2** may consist of a plastic film, a non-woven material coated with a liquid impervious material or a hydrophobic nonwoven material, which resists liquid penetration.

The backsheet **2** and the topsheet **3** have a somewhat larger extension in the plane than the absorbent body **4** and extend beyond the edges of this. The layers **2** and **3** are mutually connected within the projecting portions, for example through joining using adhesive or welding using heat or ultra sonic.

The absorption body **4** may be of any conventional kind. Examples of common absorption material are cellulosic fluff pulp, tissue layers, highly absorbent polymers (so-called superabsorbents), absorbent foam materials, absorbent nonwoven materials or the like. It is common to combine cellulosic fluff pulp with superabsorbents in an absorbent body. It is also common to use absorbent bodies comprising layers of different materials having different properties with respect to liquid acquisition capacity, liquid distribution capacity and storage capacity. It is well known to the person skilled in the art and does therefore not have to be described in detail. The thin absorbent bodies, which are common in for instance baby diapers and incontinence guards, often consists of an compressed mixed or layered structure of cellulosic fluff pulp and superabsorbent.

The diaper/incontinence guard are intended to enclose the lower part of the wearer's trunk like a pair of absorbent pants. It comprises a front portion **5**, intended during use to be worn on the front part of the user, a rear portion **6**, intended during use to be worn on the rear part of the user, and a more narrow crotch portion **7** located between the font and rear portion, which are intended to be worn in the crotch part of the user between the legs. The front portion **5** exhibits side flaps **8**, which can be provided with a kind of fastening means **16**, such as adhesive tape portions or hooks and loops fasteners. The rear portion **6** is also provided with side flaps **9**, which in the embodiment shown in FIGS. **1** and **2** are extended with a pair of belt parts **10**, whereof at least one at its end portion are provided with a fastening means **15**, such

as adhesive tape portions or hooks and loops fastener. The belt parts **10** are intended to be attached in front of the waist of the wearer by means of fastening means **15**. The front portion **5** are then attached to the belt parts **10** by means of fastening means **16** at the side flaps **8** of the front parts.

In one embodiment the diaper has at least one first pre-stressed elastic means **11***a* a arranged preferably between the absorption body **4** and the liquid impermeable back sheet material **2** and is attached at least to the back sheet material **2**. The elastic means **11***a* is arranged in an essentially V-shaped pattern having the peak of the pattern located to a point **13** essentially located on the longitudinal centre line **12** of the article on said crotch region **7**. The ends of the V-shaped pattern extend towards the side flaps **8** of the front portion **5**. This gives a sealing of the diaper against the groins of the wearer. The article may be a so called belt diaper, as shown in FIGS. **1** and **2**, a common so-called all-in one diaper as shown in FIG. **3** or a pant diaper (not shown), in which the side flaps of the front and rear portion are attached to each other so that the diaper has a pantlike form already before usage.

As mentioned above the liquid permeable topsheet **2** and the liquid impermeable backsheet **3** extend beyond the edges of the absorbent body **4**, whereby parts of the front portion as well as the rear portion **5**, **6** and also the side flaps **8**, **9**, consist of such projecting and mutually joined portions of the topsheet and the backsheet **2** and **3** outside the absorbent body **4**. The diverging ends of the first V-shaped elastic means **11***a* extend into said projecting portions and are attached between the topsheet **2** and the backsheet **3**.

In the case of a belt diaper the diverging ends of the V-shaped elastic means **11***a* extend adjacent to or even connect to the attachment means **16**, which are located on the side flaps **8** of the front portion **5** and are intended to be attached to the belt portions **10**. Hereby is a stretching of the elastic means **11***a* achieved when the diaper is attached together at the application on the user by means of attachment means **16**.

In the case of a all-in-one diaper, where the attachment means preferably are located on the side flaps **9** on the rear portion, the elastic means **11** extend in the direction towards the upper edge of the front portion **5**. In the case of a pant diaper, having no attachment means, the elastic means **11** also extend in the direction towards the upper edge of the front portion **5**.

According to a preferred embodiment a second elastic means **11***b* is arranged starting from the peak of the first V-shaped means **11***a* and extend further along the longitudinal centre line **12** in the crotch portion in the direction towards the rear portion **6**. Also the second elastic means **11***b* is preferably arranged between the backsheet **3** and the absorbent body **4** and are at least attached to the backsheet **3**. This leads to a lifting of the centre portion of the crotch portion **7** against the crotch region of the wearer, which brings the absorbent body in contact with the wearer leading to a rapid and effective absorption of the liquid.

Further, there is preferably a third elastic means **11***c* is brought in a second essentially V-shaped pattern. The peak of the pattern is located to a point **14** at the longitudinal centre line **12** on the diaper in said crotch portion **7** and the pattern diverge from the point **14** it direction towards the side flaps **9** of the rear portion **5**. The third elastic means **11***c* is also preferably arranged between the backsheet **3** and the absorbent body **4** and is at least attached to the backsheet **3**. This gives a further sealing from behind of the diaper against the wearer.

The diverging ends of the third elastic means **11***c* extend towards the upper edge of the rear portion **6** in the area of the side flaps **9**, whereby they extend into said projecting portions of the topsheet **2** and the backsheet **3** outside the absorbent body and are attached between these layers. This applies for the belt diaper shown in FIGS. **1** and **2**, the all-in-one diaper shown in FIG. **3**, and for a pant diaper.

In a preferred embodiment the first, second and the third elastic means **11***a*, **11***b* **11***c* consist of two symmetric elastic means **11**. The elastic means **11** essentially extend parallel along the crotch portion **7** and diverge essentially symmetrical from said first point **13** and said second point **14**. This embodiment is especially preferred from a production point of view.

The elastic means may consist of elastic ribbons, elastic wire or the like.

Of course, the invention are not limited to the above described and on the drawings shown embodiments, but can be varied within the scope of the claims.

What is claimed is:

1. Absorbent article such as a diaper and an incontinence guard comprising a liquid permeable topsheet, a liquid impermeable backsheet and an absorbent body enclosed therebetween, said article having a front portion, a rear portion and a crotch portion therebetween, whereby the front and rear portion exhibit side flaps, which are intended to attach the article together to a pantlike shape around the waist of the user, characterised in, that it comprises at least one first pre-stressed elastic means attached at least to the backsheet, that said first elastic means is arranged in an essentially V-shaped pattern having the peak of the pattern located to a first point being essentially located on a imagined longitudinal centre line in said crotch portion and that the V-shaped elastic means diverge in the direction from said longitudinal centre line toward the front portion, and that a second elastic means extending from the peak of the V-shaped means and further along the longitudinal centre line at the crotch portion in direction towards the rear portion.

2. Absorbent article according to claim **1**, characterised in, a third elastic means is arranged in a second essentially V-shaped pattern having the peak of the pattern located to a second point at the longitudinal centre line on the article on said crotch portion, the pattern diverging from the second point in direction from said longitudinal centre line towards the rear portion.

3. Absorbent article according to claim **1**, characterised in, that the first, second and third elastic means comprise two essentially symmetrical elastic means extending essentially parallel along the crotch portion between the first and second point and and diverging essentially symmetrical from said first point and said second point respectively.

4. Absorbent article according to claim **1**, and of the kind where the liquid permeable topsheet and the liquid impermeable backsheet has a longer extension in the plane than the absorbent body and extend beyond the edges of the same, wherein the topsheet and the backsheet are mutually joined at said projecting portions, characterised in, that the diverging ends of the first and/or the third V-shaped elastic means extend into said projecting and joined portions of the topsheet and the backsheet at the front portion and the rear portion of the article and are attached between the topsheet and the backsheet.

5. Absorbent article according to claim **4**, characterised in, that the diverging ends of the first and/or the third V-shaped elastic means extend to the side flaps of the front and rear portion respectively.

6. Absorbent article according to claim **5**, characterised in, that the ends of the first elastic means are connected to the attachment means arranged at the side flaps on the front portion.

7. Absorbent article according to claim **1**, characterised in, that the article is an all-in-one diaper, at which the side flaps of the rear and/or front portion exhibits attachment means intended to be attached to the opposite portion.

8. Absorbent article according to claim **1**, characterised in, that the article is a pant diaper, at which the side flaps of the rear and front portion respectively are fixedly connected to each other.

9. Absorbent article such as a diaper and an incontinence guard comprising a liquid permeable topsheet, a liquid impermeable backsheet and an absorbent body enclosed therebetween, said article having a front portion, a rear portion and a crotch portion therebetween, whereby the front and rear portion exhibit side flaps, a pair of belt portions are connected to said side flaps of the rear or front portion and which belt portions are intended to be attached around the waist of the user and the side flaps of the opposite portion are intended to be attached to the belt portions by means of attachments means, characterised in, that it comprises at least one first pre-stressed elastic means attached at least to the backsheet, that said first elastic means is arranged in an essentially V-shaped pattern having the peark of the pattern located to a first point being essentially located on a imagined longitudinal centre line in said crotch portion and that the V-shaped elastic means diverge in the direction from said longitudinal centre line in said crotch portion and that the V-shaped elastic means diverge in the direction from said longitudinal centre line toward the front portion.

10. Absorbent article according to claim **9**, characterised in, a second elastic means extending from the peak of the V-shaped means and further along the longitudinal centre line at the crotch portion in direction towards the rear portion.

11. Absorbent article according to claim **9**, characterised in, a third elastic means is arranged in a second essentially V-shaped pattern having a peak of the pattern located to a second point at the longitudinal centre line on the article on said crotch portion, the pattern diverging from the second point in direction from said longitudinal centre line towards the rear portion.

12. Absorbent article according to claim **9**, characterised in, that the first, second and third elastic means comprise two essentially symmetrical elastic means extending essentially parallel along the crotch portion between the first and second point and and diverging essentially symmetrical from said first point and said second point respectively.

13. Absorbent article according to claim **9**, and of the kind where the liquid permeable topsheet and the liquid impermeable backsheet has a longer extension in the plane than the absorbent body and extend beyond the edges of the same, wherein the topsheet and the backsheet are mutually joined at said projecting portions, characterised in, that the diverging ends of the first ans/or the third V-shaped elastic means extend into said projecting and joined portions of the topsheet and the backsheet at the front portion and the rear portion of the article and are attached between the topsheet and the backsheet.

14. Absorbent article according to claim **13**, characterised in, that the diverging ends of the first and for the third V-shaped elastic means extend to the side flaps of the front and rear portion, respectively.

15. Absorbent article according to claim **14**, characterised in, that the ends of the first elastic means are connected to the attachment means arranged at the side flaps on the front portion.

* * * * *

US005575783A

United States Patent [19]

Clear et al.

[11] Patent Number: 5,575,783

[45] Date of Patent: Nov. 19, 1996

[54] **ABSORBENT ARTICLE WITH DYNAMIC ELASTIC FEATURE COMPRISING ELASTICIZED HIP PANELS**

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[73] Assignee: **The Procter & Gamble Company**, Cincinnati, Ohio

[21] Appl. No.: **225,357**

[22] Filed: **Apr. 7, 1994**

Related U.S. Application Data

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[51] **Int. Cl.**[6] **A61F 13/15**

[52] **U.S. Cl.** **604/385.1**; 604/385.2

[58] **Field of Search** ..... 604/385.2, 378, 604/385.1; 2/78 B, 78 C, 78.1, 78.2, 78.3, 400–402; 156/163, 164

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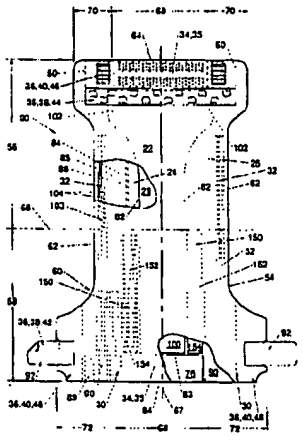
Attorney, Agent, or Firm—Steven W. Miller; E. Kelly Linman; Jacobus C. Rasser

[57] **ABSTRACT**

Absorbent articles such as disposable diapers, incontinent briefs, diaper holders, training pants, and the like, that provide dynamic fit about the wearer by the use of elasticized hip panels. Such absorbent articles comprise a liquid pervious topsheet; a liquid impervious backsheet; an absorbent core disposed between the topsheet and the backsheet; elasticized side panels positioned in the side panels of the back waist region; and an elasticized hip panel positioned in the central region of the back waist region. The elasticized hip panel comprises a stretch laminate comprising one or more elongatable components and an elastic hip panel member that are mechanically stretched to allow expansion of the stretch laminate beyond the original planar state of the diaper in the lateral direction. By adding stretch to the middle-back of the absorbent article, the absorbent article is capable of expanding in the back waist region thereby creating a more three-dimensional fit to better contour the hips and buttocks and to more completely wrap the wearer's hips and buttocks. In an alternative embodiment, a single elastic hip panel member is positioned in most of the central region of the back waist region with the stretch laminate being mechanically stretched in selected zones or preferably over the entire area of the elastic hip panel member. The absorbent core is either stretchable or preferably not attached to the stretch laminate in the mechanically stretched zones to not encumber the stretch of the stretch laminate. The topsheet is also preferably stretchable.

16 Claims, 2 Drawing Sheets



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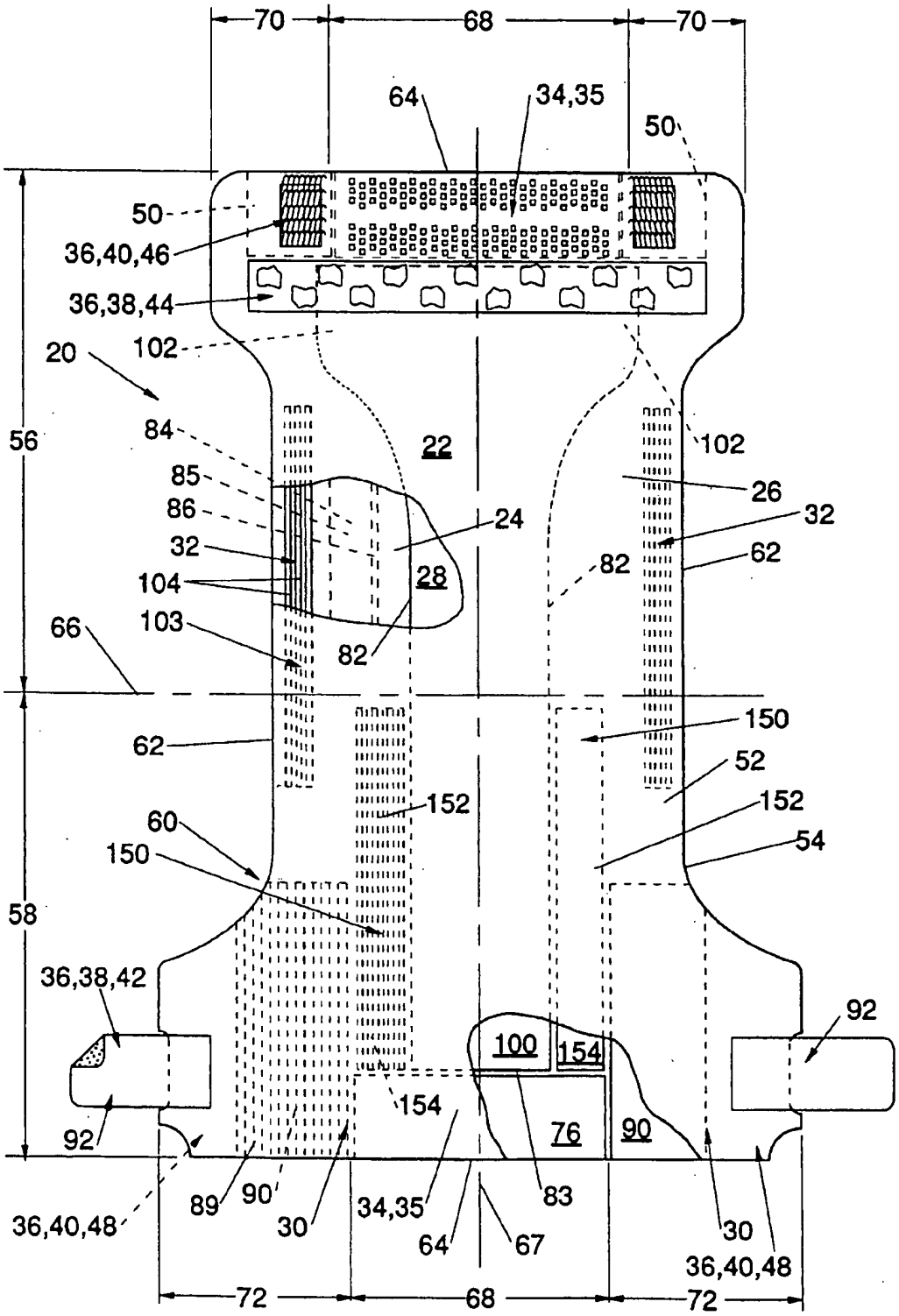
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Fig. 1

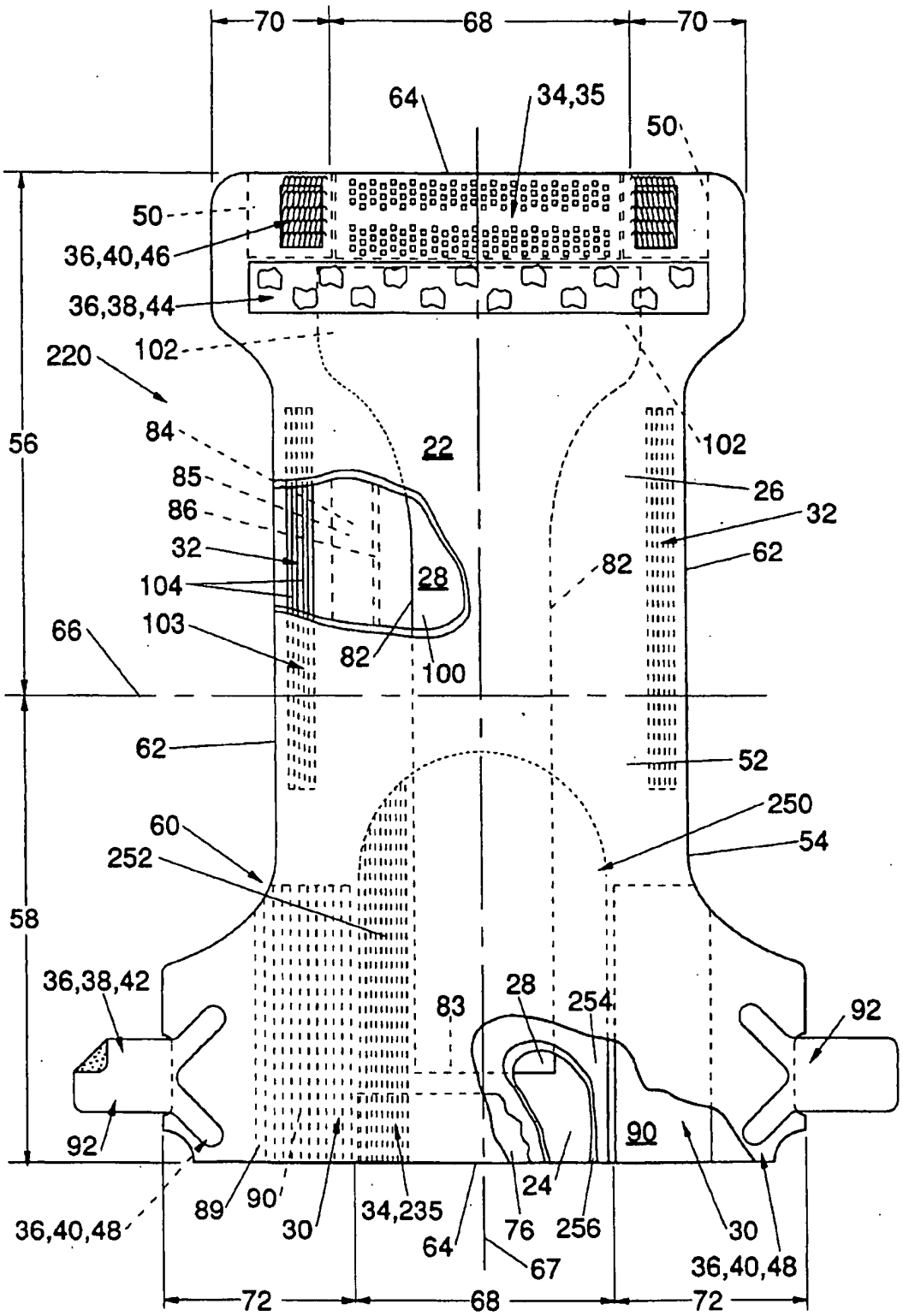
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Fig. 2

ABSORBENT ARTICLE WITH DYNAMIC ELASTIC FEATURE COMPRISING ELASTICIZED HIP PANELS

This is a continuation of application Ser. No. 07/951,982, filed on Sept. 28, 1992, now abandoned.

FIELD OF THE INVENTION

The present invention relates to absorbent articles such as diapers, incontinent briefs, diaper holders, training pants, and the like, and more particularly, to absorbent articles having elastic features providing dynamic fit about the wearer.

BACKGROUND OF THE INVENTION

Infants and other incontinent individuals wear absorbent articles such as diapers to receive and contain urine and other body exudates. Absorbent articles function both to contain the discharged materials and to isolate these materials from the body of the wearer and from the wearer's garments and bed clothing. Disposable absorbent articles having many different basic designs are known to the art. For example, U.S. Pat. Re. No. 26,152, entitled "Disposable Diaper" issued to Duncan and Baker on Jan. 31, 1967, describes a disposable diaper which has achieved wide acceptance and commercial success. In order to provide better fit and reduced leakage about the leg of the wearer, absorbent articles have been provided with elastic leg closures, elastic waist features, and elasticized side panels. U.S. Pat. No. 3,860,003, entitled "Contractable Side Portions For Disposable Diaper", issued to Kenneth B. Buell on Jan. 14, 1975, describes an elasticized leg cuff disposable diaper which has achieved wide acceptance and commercial success.

However, it has been found that absorbent articles having elastic closures still have a tendency to gap away from the wearer during use. These problems have been found to be caused by the relative motions of the wearer during use. As the wearer changes position, there are significant dimensional changes in the waist, stomach, hips, buttocks, and legs. These dimensional changes are particularly noticeable for infants. The circumference of the infant from hip to hip through the buttocks is much bigger than through the front waist/stomach area. Thus, as the wearer moves, conventional diapers are unable to expand and contract in proportion to the circumference of the wearer in the hips through the buttocks due to their construction with relatively non-elastic materials. Thus, the diaper tends to sag, gap and slip to a degree that fit is degraded and the likelihood of leakage is increased. Further, since the diaper cannot expand to accomodate these circumferential changes in dimension, pressure is applied to the body that can cause skin marking.

Thus, it would be advantageous to provide an absorbent article having elastic features that provide better fit.

Therefore, it is an object of the present invention to provide an absorbent article having dynamic fit particularly in the hips through the buttocks.

It is a further object of the present invention to provide an absorbent article having an elastic feature that provides sustained dynamic fit as the wearer moves.

These and other objects of the present invention will be more readily apparent when considered in reference to the following description and when taken in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

The present invention provides absorbent articles such as disposable diapers, incontinent briefs, diaper holders, training pants, and the like, that provide dynamic fit around the wearer. Such absorbent articles comprise a liquid pervious topsheet; a liquid impervious backsheet; an absorbent core disposed between the topsheet and the backsheet; an elastic waist feature positioned in the central region of the back waist region; elasticized side panels positioned in the side panels of the back waist region; and an elasticized hip panel positioned in the central region of the back waist region. The elasticized hip panel comprises a stretch laminate comprising one or more elongatable components (typically at least the backsheet) and an elastic hip panel member that are mechanically stretched to allow expansion of the stretch laminate beyond the original planar state of the laminate in the lateral direction. The elasticized hip panel preferably comprises a zero strain stretch laminate. Adding stretch to the middle-back of the absorbent article, in conjunction with the elasticized side panels and the elastic waist feature in the back waist region, creates an absorbent article that is capable of expanding in the back waist region so as to be wider in the back than in the front thereby creating a more three-dimensional fit to better contour to the hips and buttocks. This allows the absorbent article to more completely wrap around the wearer's hips and buttocks and provide stretch which better fits the tops of the legs. As a result, the absorbent article has less gapping at the hips and the sides of the buttocks, helps to prevent leakage in these regions, reduces sagging, and reduces the stress on the diaper in the hip area during use.

In an alternative embodiment of the present invention, a single elastic hip panel member is positioned in most of the central region of the back waist region. The stretch laminate of the elastic hip panel member, the backsheet, and a laminate coversheet is mechanically stretched in selected zones or preferably over the entire area of the elastic hip panel member to provide expansion throughout the central region of the back waist region. The absorbent core is either stretchable or preferably not attached to the stretch laminate in the mechanically stretched zones to not encumber the stretch of the stretch laminate. The topsheet is also preferably stretchable.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which like designations are used to designate substantially identical elements, and in which:

FIG. **1** is a plan view of a disposable diaper embodiment of the present invention having portions cut-away to reveal underlying structure, the outer surface of the diaper facing the viewer; and

FIG. **2** is a plan view of an alternative disposable diaper embodiment of the present invention having portions cut-away to reveal underlying structure, the outer surface of the diaper facing the viewer.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, the term "absorbent article" refers to devices which absorb and contain body exudates, and, more

specifically, refers to devices which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "disposable" is used herein to describe absorbent articles which are not intended to be laundered or otherwise restored or reused as an absorbent article (i.e., they are intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner). A "unitary" absorbent article refers to absorbent articles which are formed of separate parts united together to form a coordinated entity so that they do not require separate manipulative parts like a separate holder and liner. A preferred embodiment of an absorbent article of the present invention is the unitary disposable absorbent article, diaper **20**, shown in FIG. **1**. As used herein, the term "diaper" refers to an absorbent article generally worn by infants and incontinent persons that is worn about the lower torso of the wearer. It should be understood, however, that the present invention is also applicable to other absorbent articles such as incontinent briefs, incontinent undergarments, diaper holders and liners, feminine hygiene garments, training pants, and the like.

FIG. **1** is a plan view of the diaper **20** of the present invention in its flat-out, uncontracted state (i.e., with elastic induced contraction pulled out except in the side panels and hip panels wherein the elastic is left in its relaxed condition) with portions of the structure being cut-away to more clearly show the construction of the diaper **20** and with the portion of the diaper **20** which faces away from the wearer, the outer surface **52**, facing the viewer. As shown in FIG. **1**, the diaper **20** comprises a containment assembly **22** preferably comprising a liquid pervious topsheet **24**, a liquid impervious backsheet **26** joined with the topsheet **24**, and an absorbent core **28** positioned between the topsheet **24** and the backsheet **26**; elasticized side panels **30**; elasticized leg cuffs **32**; an elastic waist feature **34**; a fastening system **36**; and elasticized hip panels **150**. Each elasticized hip panel **150** comprises a stretch laminate **152** preferably comprising a portion of the backsheet **26**, a portion of the topsheet **24**, and an elastic hip panel member **154** disposed therebetween.

The diaper **20** is shown in FIG. **1** to have an outer surface **52** (facing the viewer in FIG. **1**), an inner surface **54** opposed to the outer surface **52**, a front waist region **56**, a back waist region **58**, and a periphery **60** which is defined by the outer edges of the diaper **20** in which the longitudinal edges are designated **62** and the end edges are designated **64**. The inner surface **54** of the diaper **20** comprises that portion of the diaper **20** which is positioned adjacent to the wearer's body during use (i.e., the inner surface **54** generally is formed by at least a portion of the topsheet **24** and other components joined to the topsheet **24**). The outer surface **52** comprises that portion of the diaper **20** which is positioned away from the wearer's body (i.e., the outer surface **52** generally is formed by at least a portion of the backsheet **26** and other components joined to the backsheet **26**).

The front waist region **56** and the back waist region **58** extend, respectively, from the end edges **64** of the periphery **60** to the lateral centerline **66**. The waist regions **56**, **58** each comprise a central region **68** and a pair of side panels which typically comprise the outer lateral portions of the waist regions. The side panels positioned in the front waist region **56** are designated **70** while the side panels in the back waist region **58** are designated **72**. (In the discussion that follows, unless otherwise noted, the diaper **20** will comprise a pair of side panels in each waist region. While it is not necessary that the pairs of side panels or each side panel be identical, they are preferably mirror images one of the other.) The side panels **72** positioned in the back waist region **58** are elastically extensible in the lateral direction (i.e., elasticized side panels **30**). (The lateral direction (x direction or width) is defined as the direction parallel to the lateral centerline **66** of the diaper **20**; the longitudinal direction (y direction or length) being defined as the direction parallel to the longitudinal centerline **67**; and the axial direction (Z direction or thickness) being defined as the direction extending through the thickness of the diaper **20**.)

The containment assembly **22** of the diaper **20** is shown in FIG. **1** as comprising the main body (chassis) of the diaper **20**. The containment assembly **22** comprises at least an absorbent core **28** and preferably an outer covering layer comprising the topsheet **24** and the backsheet **26**. When the absorbent article comprises a separate holder and a liner, the containment assembly **22** generally comprises the holder and the liner (i.e., the containment assembly **22** comprises one or more layers of material to define the holder while the liner comprises an absorbent composite such as a topsheet, a backsheet, and an absorbent core.) For unitary absorbent articles, the containment assembly **22** comprises the main structure of the diaper with other features added to form the composite diaper structure. Thus, the containment assembly **22** for the diaper **20** generally comprises the topsheet **24**, the backsheet **26**, and the absorbent core **28**.

The absorbent core **28** may be any absorbent means which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining liquids such as urine and other certain body exudates. As shown in FIG. **1**, the absorbent core **28** has a garment surface **100**, a body surface **101**, side edges **82**, and waist edges **83**.

The absorbent core **28** may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, hourglass, "T"-shaped, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in disposable diapers and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding, meltblown polymers including coform, cross-linked cellulosic fibers, tissue including tissue wraps and tissue laminates, absorbent foams, absorbent sponges, superabsorbent polymers, absorbent gelling materials, or any equivalent material or combinations of materials. The configuration and construction of the absorbent core may also be varied (e.g., the absorbent core may have varying caliper zones, a hydrophilic gradient, a superabsorbent gradient, or lower average density and lower average basis weight acquisition zones; or may comprise one or more layers or structures). The total absorbent capacity of the absorbent core **28** should, however, be compatible with the design loading and the intended use of the diaper **20**. Further, the size and absorbent capacity of the absorbent core **28** may be varied to accommodate wearers ranging from infants through adults.

A preferred embodiment of the diaper **20** has an asymmetric, modified T-shaped, absorbent core **28** having ears **102** in the front waist region **56** but a generally rectangular shape in the back waist region **58**. This configuration allows wider elasticized side panels **30** in the back waist region **58**. An exemplary absorbent structure for use as the absorbent core **28** of the present invention that has achieved wide acceptance and commercial success is described in U.S. Pat. No. 4,610,678 entitled "High-Density Absorbent Structures" issued to Weisman and Goldman on Sept. 9, 1986. U.S. Pat. No. 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to Weisman, Houghton, and Gellert on Jun. 16, 1987; and U.S. Pat. No. 4,888,231 entitled "Absor-

bent Core Having A Dusting Layer" issued to Angstadt on Dec. 19, 1989; also describe absorbent structures that are useful in the present invention. The absorbent core **28** is preferably the commercially successful absorbent member described in U.S. Pat. No. 4,834,735, entitled "High Density Absorbent Members Having Lower Density and Lower Basis Weight Acquisition Zones", issued to Alemany and Berg on May 30, 1989. The absorbent core may further comprise the dual core system containing an acquisition/distribution core of chemically stiffened fibers positioned over the absorbent storage cores as detailed in co-pending U.S. patent application Ser. No. 07/843,706, "Absorbent Article With Elastic Waist Feature and Enhanced Absorbency", Clear and Alemany, filed on Feb. 28, 1992; and in U.S. Pat. No. 5,147,345, "High Efficiency Absorbent Articles For Incontinence Management", which issued to Young, LaVon and Taylor on Sept. 15, 1992. All of these references are incorporated herein by reference.

The backsheet **26** is positioned adjacent the garment surface **100** of the absorbent core **28** and is preferably joined thereto by attachment means (not shown) such as those well known in the art. For example, the backsheet **26** may be secured to the absorbent core **28** by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by Century Adhesives, Inc. of Columbus, Ohio and marketed as Century 5227; and by H. B. Fuller Company of St. Paul, Minn. and marketed as HL-1258. The attachment means will preferably comprise an open pattern network of filaments of adhesive as is disclosed in U.S. Pat. No. 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola and Tucker on Mar. 4, 1986, and which is incorporated herein by reference. An exemplary attachment means of an open pattern network of filaments comprises several lines of adhesive filaments swirled into a spiral pattern such as is illustrated by the apparatus and methods shown in U.S. Pat. No. 3,911,173 issued to Sprague, Jr. on Oct. 7, 1975; U.S. Pat. No. 4,785,996 issued to Ziecker, et al. on Nov. 22, 1978; and U.S. Pat. No. 4,842,666 issued to Werenicz on Jun. 27, 1989. Each of these patents are incorporated herein by reference. Alternatively, the attachment means may comprise heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art.

The backsheet **26** is impervious to liquids (e.g., urine) and is preferably manufactured from a thin plastic film, although other flexible liquid impervious materials may also be used. As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and contours of the human body. The backsheet **26** prevents the exudates absorbed and contained in the absorbent core **28** from wetting articles which contact the diaper **20** such as bedsheets and undergarments. The backsheet **26** may thus comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. Preferably, the backsheet is a thermoplastic film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils).

In a preferred embodiment of the present invention, at least a portion of the backsheet **26** is subjected to mechanical stretching in order to provide both a "zero strain" stretch laminate that forms the elasticized side panels **30** and the elasticized hip panels **150** and, optionally, to mechanically prestrain the portion of the backsheet coinciding with the elastic waist feature or the elastic leg feature. Thus, the backsheet **26** is preferably elongatable, most preferably drawable, but not necessarily elastomeric, so that the backsheet **26** will, upon mechanical stretching, be at least to a degree permanently elongated such that it will not fully return to its original undistorted configuration. In preferred embodiments, the backsheet can be subjected to mechanical stretching without undue rupturing or tearing. Thus, it is preferred that the backsheet **26** have an ultimate elongation to break of at least about 400% to about 700% in the cross-machine direction as measured using a method consistent with ASTM D-638. Thus, preferred polymeric films for use as the backsheet contain a high content of linear low density polyethylene. Particularly preferred materials for the backsheet include blends comprised of about 45–90% linear low density polyethylene and about 10–55% polypropylene. Exemplary films for use as the backsheet of the present invention are manufactured by Tredegar Industries, Inc. of Terre Haute, Ind. under the designation RR8220 blend for blown films and RR5475 blend for cast films. The backsheet **26** is preferably embossed (typically, to a caliper of about 0.127 mm (5.5 mils)) and/or matte finished to provide a more clothlike appearance. Further, the backsheet **26** may permit vapors to escape from the absorbent core **28** (i.e., breathable) while still preventing exudates from passing through the backsheet **26**.

The size of the backsheet **26** is dictated by the size of the absorbent core **28** and the exact diaper design selected. In a preferred embodiment, the backsheet **26** has a modified hourglass shape extending beyond the absorbent core **28** around the entire diaper periphery **60**. Preferably, the backsheet **26** is much wider than the absorbent core **28** in the back waist region **58** so that the side panels **72** and the portion of the central region **68** wherein the absorbent core is not disposed, the hip panels **69**, are generally wide.

The topsheet **24** is positioned adjacent the body surface **101** of the absorbent core **28** and is preferably joined thereto and to the backsheet **26** by attachment means (not shown) such as those well known in the art. Suitable attachment means are described with respect to joining the backsheet **26** to the absorbent core **28**. As used herein, the term "joined" encompasses configurations whereby an element is directly secured to the other element by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element. In a preferred embodiment of the present invention, the topsheet **24** and the backsheet **26** are joined directly to each other in the diaper periphery **60** and are indirectly joined together by directly joining them to the absorbent core **28** by the attachment means (not shown).

The topsheet **24** is compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet **24** is liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet may be manufactured from a wide range of materials, such as porous foams; reticulated foams; apertured plastic films; or woven or nonwoven webs of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polyester or polypropylene fibers), or a combination of natural and synthetic fibers. Preferably, the topsheet **24** is made of a hydrophobic material to isolate the wearer's skin from liquids contained in the absorbent core **28** (i.e., prevent "rewet").

In a preferred embodiment of the present invention, at least a portion of the topsheet **24** is subjected to mechanical stretching in order to provide a "zero strain" stretch laminate that forms the elasticized side panels **30** and the elasticized

hip panels **150**. Thus, the topsheet **24** is preferably elongatable, most preferably drawable, but not necessarily elastomeric, so that the topsheet **24** will, upon mechanical stretching, be at least to a degree permanently elongated such that it will not fully return to its original configuration. In preferred embodiments, the topsheet **24** can be subjected to mechanical stretching without undue rupturing or tearing of the topsheet. Thus, it is preferred that the topsheet **24** have a low cross-machine direction (lateral direction) yield strength.

There are a number of manufacturing techniques which may be used to manufacture the topsheet **24**. For example, the topsheet **24** may be a nonwoven web of fibers. When the topsheet comprises a nonwoven web, the web may be spunbonded, carded, wet-laid, meltblown, hydroentangled, combinations of the above, or the like. A preferred topsheet is carded and thermally bonded by means well known to those skilled in the fabrics art. A preferred topsheet comprises staple length polypropylene fibers having a denier of about 2.2. As used herein, the term "staple length fibers" refers to those fibers having a length of at least about 15.9 mm (0.625 inches). Preferably, the topsheet has a basis weight from about 18 to about 25 grams per square meter. A suitable topsheet is manufactured by Veratec, Inc., a Division of International Paper Company, of Walpole, Mass. under the designation P-8.

The diaper **20** preferably comprises an elastic leg feature **32** for providing improved containment of liquids and other body exudates. Each elastic leg feature **32** may comprise several different embodiments for reducing the leakage of body exudates in the leg region. (The leg feature can be and is sometimes also referred to as leg bands, side flaps, barrier cuffs, or elastic cuffs.) U.S. Pat. No. 3,860,003 describes a disposable diaper which provides a contractible leg opening have a side flap and one or more elastic members to provide an elasticized leg cuff (gasketing cuff). U.S. Pat. No. 4,909,803 entitled "Disposable Absorbent Article Having Elasticized Flaps" issued to Aziz, et al. on Mar. 20, 1990, describes a disposable diaper having "stand-up" elasticized flaps (barrier cuffs) to improve the containment of the leg regions. U.S. Pat. No. 4,695,278 entitled "Absorbent Article Having Dual Cuffs" issued to Lawson on Sept. 22, 1987, describes a disposable diaper having dual cuffs including a gasketing cuff and a barrier cuff. While each elastic leg feature **32** may be configured so as to be similar to any of the leg bands, side flaps, barrier cuffs, or elastic cuffs described above, it is preferred that each elastic leg feature **32** comprise an elasticized gasketing cuff **103** and a barrier leg cuff **84** such as described in the above referenced U.S. Pat. No. 4,695,278. As shown in FIG. **1**, the elasticized gasketing cuff **103** comprises a portion of the topsheet **24**, a portion of the backsheet **26**, and a plurality of elastic members **104** positioned therebetween while the elasticized barrier cuff **84** comprises a barrier flap **85** and one or more spacing elastic members **86**.

The diaper **20** preferably further comprises an elastic waist feature **34** that provides improved fit and containment. The elastic waist feature **34** is that portion or zone of the diaper **20** which is intended to elastically expand and contract to dynamically fit the wearer's waist. The elastic waist feature **34** at least extends longitudinally outwardly from at least one of the waist edges **83** of the absorbent core **28** and generally forms at least a portion of the end edge **64** of the diaper **20**. Disposable diapers are generally constructed so as to have two elastic waist features, one positioned in the front waist region and one positioned in the back waist region, although diapers can be constructed with a single elastic waist feature. Further, while the elastic waist feature or any of its constituent elements can comprise a separate element affixed to the diaper, the elastic waist feature **34** is preferably constructed as an extension of other elements of the diaper **20** such as the backsheet **26** or the topsheet **24**, preferably both the backsheet **26** and topsheet **24**. As shown in FIG. **1**, the elastic waist feature **34** comprises an elasticized waistband **35** which at least comprises an elastic waist member **76**, preferably comprising a crosslinked natural rubber foam, operatively associated between the topsheet **24** and the backsheet **26**. The elasticized waistband **35** may be constructed in a number of different configurations including that described in U.S. Pat. No. 4,515,595 issued to Kievit, et al. on May 7, 1985. In a particularly preferred embodiment, the elastic waist feature comprises those described in U.S. patent application Ser. No. 07/750,775 of Buell, Clear and Falcone, filed on Aug. 22, 1991, allowed. Each of these references are incorporated herein by reference.

The diaper **20** further comprises elasticized side panels **30** disposed in the back waist region **58**. (As used herein, the term "disposed" is used to mean that an element(s) of the diaper is formed (joined and positioned) in a particular place or position as a unitary structure with other elements of the diaper or a separate element joined to another element of the diaper. The elasticized side panels **30** provide an elastically extensible, preferably elastically expandable, feature that provides a more comfortable and contouring fit by initially conformably fitting the diaper to the wearer and sustaining this fit throughout the time of wear well past when the diaper has been loaded with exudates since the elasticized side panels allow the side of the diaper to expand and contract. The elasticized side panels **30** further provide more effective application of the diaper **20** since even if the diaperer pulls one elasticized side panel farther than the other during application (asymmetrically), the diaper **20** will "self-adjust" during wear. While the diaper **20** of the present invention has the elasticized side panels **30** disposed in the back waist region **58**; alternatively, the diaper **20** may also be provided with elasticized side panels **30** disposed in the front waist region **56**. While the elasticized side panels **30** may be constructed in a number of configurations, examples of diapers with elasticized side panels positioned in the ears (ear flaps) of the diaper are disclosed in U.S. Pat. No. 4,857,067 entitled "Disposable Diaper Having Shirred Ears" issued to Wood, et al. on Aug. 15, 1989; U.S. Pat. No. 4,381,781 issued to Sciaraffa, et al. on May 3, 1983; U.S. Pat. No. 4,938,753 issued to Van Gompel, et al. on Jul. 3, 1990; and the hereinbefore referenced U.S. patent application Ser. No. 07/750,775 of Buell, Clear and Falcone, filed on Aug. 22, 1991, allowed; each of which are incorporated herein by reference. The preferred elasticized side panels **30** comprise a side panel stretch laminate **89** comprising an elongatable component(s) (typically a portion of the topsheet **24** and a portion of the backsheet **26**) and an elastic side panel member **90** positioned therebetween that is mechanically stretched. The side panel stretch laminate **89** preferably comprises a zero strain stretch laminate formed using the method and apparatus as described herein with respect to the elasticized hip panels and in U.S. Pat. No. 5,143,679.

The diaper **20** is also provided with a fastening system **36** which forms a side closure which maintains the front waist region **56** and the back waist region **58** in an overlapping configuration such that lateral tensions are maintained around the circumference of the diaper to maintain the diaper on the wearer. Exemplary fastening systems are

disclosed in U.S. Pat. No. 4,846,815 entitled "Disposable Diaper Having An Improved Fastening Device" issued to Scripps on Jul. 11, 1989; U.S. Pat. No. 4,894,060 entitled "Disposable Diaper With Improved Hook Fastener Portion" issued to Nestegard on Jan. 16, 1990; U.S. Pat. No. 4,946, 527 entitled "Pressure-Sensitive Adhesive Fastener and Method of Making Same" issued to Battrell on Aug. 7, 1990; U.S. Pat. No. 3,848,594 entitled "Tape Fastening System for Disposable Diaper" issued to Buell on Nov. 19, 1974; and U.S. Pat. No. B14,662,875 entitled "Absorbent Article" issued to Hirotsu, et al. on May 5, 1987. In a preferred embodiment, the diaper is provided with a closure system (tensioning means) for dynamically creating/maintaining lateral tension through the elasticized waistband **35**. The lateral tension dynamically created and maintained by the closure system "activates" the stretch of the elasticized waistband **35** thereby allowing it to more dynamically expand and contract with the motions of the wearer. Gapping of the elasticized waistband is also reduced by the activated stretch since it is held in tension to snugly fit against the wearer's waist both when the diaper is initially fitted to the wearer and during use. While the closure system may take on a number of configurations such as adhesive tape tabs, mechanical closure tape tabs, fixed position fasteners, or any other means for tensioning the elasticized waistband **35** as are known in the art, as shown in FIG. **1**, the closure system preferably comprises a waist closure system **40** comprising at least one, typically a pair of, first attachment components **46** and at least one second attachment component **48**. More preferably, the fastening system **36** additionally comprises a primary fastening system **38** such that the diaper **20** has a dual tension fastening system. Preferred embodiments of a diaper having a dual tension fastening system are described in commonly assigned, co-pending, U.S. patent application Ser. No. 07/714,476, P&G Case 4412, Weil, et al., "Absorbent Article With Fastening System Providing Dynamic Elasticized Waistband Fit", filed Jun. 13, 1991; and the above referenced U.S. patent application Ser. No. 07/750, 775 of Buell, et al. filed on Aug. 22, 1991, allowed; the specifications and drawings of each being incorporated herein by reference. (In an alternative embodiment as shown in FIG. **2**, the tape tabs **92** have a Y-shaped closure on the backsheet side to provide improved distribution of stretch in the elasticized side panels **30**.)

The diaper **20** additionally preferably comprises a positioning patch **50** located subjacent the first attachment component **46**. The positioning patch **50** raises the first attachment component **46** in the Z-direction (thickness) to allow the first attachment component **46** to come in better contact with the second attachment component **48** and allow the waist closure system **40** to more easily be closed (with less effort). Thus, the waist closure system **40** is more effectively passively activated. The positioning patch **50** also provides a zone of increased flexural stiffness that reduces the tendency of the flexible ear flaps to fold over onto the first attachment component(s) **46** thereby occluding the hooks from being secured during diaper application. Thus, the positioning patch **50** can comprise any element that provides a Z-direction build-up to the first attachment components **46**. As shown in FIG. **1**, the positioning patches **50** each comprise a rectangular-shaped piece of material positioned subjacent the first attachment component **46**. While the positioning patches **50** may be positioned directly subjacent the first attachment components **46**, the positioning patches **50** are preferably positioned between the topsheet **24** and the backsheet **26**. In order to provide a flexurally stiff circumference about the waist of the wearer, the lateral edges of the positioning patches can be abutted to or slightly overlapped with the side edges of the elastic waistband member **76**.

The diaper **20** comprises one or more elasticized hip panels **150** disposed in the central region **68** of the back waist region **58**. Each elasticized hip panel **150** provides an elastically expandable feature that provides a more comfortable and contouring fit about the hips and buttocks of the wearer by initially conformably fitting the diaper **20** to the hips/buttocks and sustaining this fit throughout the time of wear since the elasticized hip panels **150** allow portions of the central region **68** of the back waist region **58** of the diaper **20** to elastically expand with the body and return to the original configuration as the body moves. This additional stretch in the middle-back of the diaper allow the diaper to better wrap around the wearer's hips and buttocks. As a result, the diaper fits better to the body and reduces sagging, gapping, and back waistband slippage. The elasticized hip panels **150** thus can improve the fit of the diaper and help to prevent leakage.

The diaper may have one or a plurality of elasticized hip panels disposed in the central region **68** of the back waist region **58**. In one embodiment as discussed hereinafter, the diaper may have only one elasticized hip panel providing stretch throughout a large area of the back waist region **58**. In another embodiment as shown in FIG. **1**, the diaper **20** has a pair of elasticized thigh panels **150**, one positioned laterally outwardly from each side edge **82** of the absorbent core **28**. In this embodiment, each elasticized thigh panel **150** is disposed in a discrete zone in the back waist region **58** defined as the area disposed laterally outwardly from the side edge **82** of the absorbent core, laterally inwardly from the elasticized side panel **30**, and longitudinally inwardly from the elastic waist feature **34**. Thus, in this embodiment, the elasticized hip panel **150** is bounded by the absorbent core **28**, the elasticized side panels **30**, the elastic waist feature **34**, and the lateral centerline **66**.

The elasticized hip panels **150** are elastically expandable in at least one direction, preferably the lateral direction, to provide better fit by providing elastic expansion that follows the hips/buttocks. It should be noted, however, that the elasticized hip panels **150** may be elastically expandable in any other direction or in more than one direction. As discussed hereinafter, lateral expansion is preferred and achieved by stretching the stretch laminate **152** of the elasticized hip panels **150** generally perpendicular to the lateral direction.

Each elasticized hip panel **150** comprises a stretch laminate **152** so that the elasticized hip panels are capable of expanding beyond the original planar state of the diaper **20**. The stretch laminate **152** comprises an elastic hip panel member **154** and one or more elongatable components (e.g., the backsheet **26** and another elongatable component layer which in the embodiment shown in FIG. **1** is the topsheet **24**) that have been mechanically stretched as hereinafter described. This stretch laminate **152** allows for expansion of the elasticized hip panel **150** beyond the initial dimension of the elongatable components to follow the dimensions of the hips/buttocks during movement.

While the stretch laminate **152** may be constructed in a number of configurations; in a preferred embodiment as shown in FIG. **1**, the stretch laminate **152** comprises a portion of the topsheet **24**, a portion of the backsheet **26**, and an elastic hip panel member **154** operatively associated with the topsheet **24**, the backsheet **26** or both, most preferably between the topsheet **24** and the backsheet **26**. In an espe-

cially preferred embodiment of the present invention, the elastic hip panel members **154** are operatively associated in an untensioned state so as to form "zero strain" stretch laminates. As used herein, the term "zero strain" stretch laminate refers to a laminate comprised of at least two plies of material which are secured to one another along at least a portion of their coextensive surfaces while in a substantially untensioned ("zero strain") condition; one of the plies comprising a material which is stretchable and elastomeric (i.e., it will return substantially to its untensioned dimensions after an applied tensile force has been released) and a second ply which is elongatable (but not necessarily elastomeric) so that upon stretching the second ply will be, at least to a degree, permanently elongated so that upon release of the applied tensile forces it will not fully return to its original undeformed configuration. The resulting "zero strain" stretch laminate is thereby rendered elastically expandable, at least up to the point of initial stretching, in the direction of initial stretching by mechanically stretching the laminate. Examples of such "zero strain" stretch laminates are disclosed in U.S. Pat. No. 2,075,189 issued to Galligan, et al. on Mar. 30, 1937; U.S. Pat. No. 3,025,199 issued to Harwood on Mar. 13, 1962; U.S. Pat. No. 4,107,364 issued to Sisson on Aug. 15, 1978; U.S. Pat. No. 4,209,563 issued to Sisson on Jun. 24, 1980; and U.S. Pat. No. 4,834,741 issued to Sabee on May 30, 1989. Each of these patents are incorporated herein by reference. Alternatively, the elastic hip panel member **154** can be operatively associated in a tensioned condition and the resulting laminate then subjected to mechanical stretching to form a pretensioned stretch laminate. For example, the elastic hip panel member may be operatively associated with the elongatable component in an elastically contractible condition so that the elastic hip panel member gathers or contracts the stretch laminate. While either of the elasticized hip panels **150** may comprise a pretensioned stretch laminate or a zero strain stretch laminate, in a preferred embodiment, both elasticized hip panels **150** comprise the same type of stretch laminate, most preferably each comprises a zero strain stretch laminate.

At least a portion of the stretch laminate **152** containing the elastic hip panel member **154** is subjected to mechanical stretching sufficient to permanently elongate the elongatable components (e.g., the backsheet **26** and the topsheet **24**) of the stretch laminate **152**. The stretch laminate **152** is then allowed to return to its substantially untensioned condition. Particularly preferred methods and apparatus used for making stretch laminates out of an elongatable component(s) (the topsheet and the backsheet) and an elastomeric member positioned between the same, use meshing corrugated rolls to mechanically stretch the components. A discussion of suitable apparatus and methods for mechanically stretching portions of a diaper is contained in U.S. Pat. No. 4,107,364 issued to Sisson on Aug. 15, 1978 and U.S. Pat. No. 4,834,741 issued to Sabee on May 30, 1989. Particularly preferred apparatus and methods are disclosed in U.S. Pat. No. 5,143,679, "Method for Sequentially Stretching Zero Strain Stretch Laminate Web to Impart Elasticity Thereto Without Rupturing the Web" issued to Weber and Richardson on Sept. 1, 1992; and in co-pending, commonly assigned, U.S. patent application Ser. No. 07/662,536 entitled "Improved Method and Apparatus for Incrementally Stretching a Zero Strain Stretch Laminate to Impart Elasticity Thereto"; P&G Case 4339; filed by Gerald M. Weber, et al. on Feb. 28, 1991, allowed; and U.S. patent application Ser. No. 07/662,537 entitled "Improved Method and Apparatus for Incrementally Stretching Zero Strain Stretch Laminate Web in a Non-Uniform Manner to Impart a Varying Degree of Elasticity Thereto"; P&G Case 4340; filed by Kenneth B. Buell, et al. on Feb. 28, 1991, allowed; each of the above references being incorporated herein by reference. In the preferred method for forming the elasticized hip panels **150** constructed using the "zero strain" stretch laminate technology herein disclosed, the meshing teeth on the pairs of corrugated rolls employed to incrementally mechanically stretch the "zero strain" stretch laminate of the elasticized hip panel **150** are arranged in a desired configuration, preferably perpendicular to the lateral direction to produce expansion in the lateral direction as depicted by the dashed lines in a portion of FIG. **1**.

The elastic hip panel member **154** may take on a number of different sizes, shapes, configurations and materials. One elastomeric material which has been found to be especially suitable for use as the elastic hip panel member **154** (especially for "zero strain" stretch laminates) is an elastomeric foam having an elongation to break of at least about 400% and an extension force of about 200 grams/in of sample width at 50% extension of its unstrained length. Exemplary elastomeric foams which have been found suitable for use as the elastic hip panel member **154** include: (a) crosslinked natural rubber foams preferably having a caliper of approximately 50 mils and a density of 13.3 lbs/cu ft. (0.214 g/cm^3), such as available from Fulflex, Inc. of Middletown, R.I.; or as available from Ludlow Composites Corporation of Freemont, Ohio and marketed under the tradename Babyfoam; or polyurethane foams having a caliper of approximately 80 mils and a density of approximately 2.06 lbs/cu ft. (0.033 g/cm^3) such as available from Bridgestone of Yokahama, Japan and marketed under the tradename Bridgestone SG polyurethane foam; or as available from General Foam of Paramis, N.J. and marketed under the designation of polyurethane foam No. 40310. Another exemplary elastomeric material is elastomeric adhesives such as the pressure-sensitive elastomeric adhesive marketed by the Findley Adhesives Corporation of Wauwatosa, Wis. under the tradename 198-338. Other suitable elastomeric materials for use as the elastic hip panel members **154** include "live" synthetic or natural rubber, other synthetic or natural rubber foams, elastomeric films (including heat shrinkable elastomeric films), elastomeric scrim, elastomeric woven or nonwoven webs, elastomeric composites such as elastomeric nonwoven laminates, or the like. As shown in FIG. **1**, the elastic hip panel members **154** each preferably comprise a patch of elastomeric material (elastomeric patch). The length and width of the elastomeric hip panel members **154** are dictated by the diaper's functional design. In the particular embodiment shown in FIG. **1**, the elastic hip panel members **154** have a rectangular shape extending from the inward edge of the elasticized waistband **35** toward the longitudinal centerline **66** between the side edges **82** of the absorbent core **28** and the elasticized side panels **30**. However, many other shapes are possible in the design of the elastic hip panel members **154**.

The diaper **20** is preferably applied to a wearer by positioning the back waist region **58** under the wearer's back and drawing the remainder of the diaper between the wearer's legs so that the front waist region **56** is positioned across the front of the wearer. The tab portions of the tape tabs **92** are then released. The diaper then wraps the elasticized side panel **30** around the wearer, while still grasping the tab. The elasticized side panels **30** and the elasticized hip panels **150** will typically be extended in tension during this operation so as to conform to the size and shape of the wearer. The fastening component is secured to the second fastening component to affect the side closure for the diaper.

FIG. 2 shows an alternative embodiment of the present invention wherein a single elastic hip panel member **254** is positioned in the central region **68** of the back waist region **58**. As shown in FIG. **2**, the elastic hip panel member **254** has an elongated semi-elliptical shape so that almost the entire central region **68** of the back waist region **58** is rendered elastically expandable. In this embodiment, the elastic hip panel member **254** comprises an elastomeric adhesive such as hereinbefore described. The stretch laminate **252** preferably comprises a portion of the backsheet **26**, a laminate coversheet **256**, and the elastic hip panel member **254** disposed therebetween. A laminate coversheet **256** is provided between the elastic hip panel member **254** and the absorbent core **28** so that the stretch laminate **252** may be activated by mechanical stretching prior to positioning the absorbent core **28** on the stretch laminate **252**. The stretch laminate **252** is preferably activated by mechanical stretching over its entire area; although, as discussed hereinafter, the stretch laminate may be activated in only selective zones. The stretch laminate **252** is preferably activated to provide stretch in at least the lateral direction as indicated by the dashed lines in part of FIG. **2**. (The apparatus used to stretch this laminate can have teeth having a width of 0.030 inches, a pitch of 0.150 inches, a depth of 0.290 inches, and an activation force of 110 g/in.). Since the stretch laminate **252** is over the entire center back of the diaper, the absorbent core is preferably allowed to "float" (be unattached to the stretch laminate **252**) in selected zones or over the entire area so that the stretch laminate **252** is allowed to freely stretch without being encumbered by the absorbent core **28**. In this particular embodiment, the absorbent core **28** is unattached to the stretch laminate over its entire extent. Further, the topsheet **24** is stretchable so as to not inhibit the stretch of the stretch laminate **252**. As shown in FIG. **2**, the elastic hip panel member **254** extends into the elasticized waistband **235**. While the elasticized waistband **235** could be formed as a portion of the stretch laminate **252**, it preferably additionally comprises an elastic waist member **76** preferably comprising a crosslinked natural rubber foam. The elasticized side panels **30** are constructed in a way to be similar to those shown in FIG. **1**. The tape tabs **92** preferably have a Y-shaped closure to provide improved distribution of stretch in the elasticized side panels **30**. With this "floating core" overall elasticized hip panel embodiment, the diaper is allowed to more completely wrap around the hips and buttocks of the wearer and provide elastic expansion to thereby better fit the wearer.

As previously discussed, the single elastic hip panel member **254** can be mechanically stretched, "activated", in selected zones or over in its entire area in the central region **68** to provide one or more elasticized hip panels **250**. For example, the stretch laminate **252** comprising the elastic hip panel member **254** can be mechanically stretched in two rectangular zones, one laterally outwardly from each side edge **82** of the absorbent core **28**. When the elastic hip panel member **254** is selectively activated in the central region laterally outwardly from the side edges of the absorbent core, the diaper acts in a similar way as the diaper embodiment depicted in FIG. **1** except that the elastic hip panel member comprises one piece of elastomeric material. Thus, the stretch laminate **252** can be mechanically stretched in many different zones to provide expansion in desired directions. In the embodiment shown in FIG. **2**, the stretch laminate **252** is mechanically stretched over the entire area of the elastic hip panel member **254**. Further, in the embodiment shown in FIG. **2**, the stretch laminate **252** comprises a portion of the backsheet **26**; a laminate coversheet **256**, preferably comprising a nonwoven material similar to those suitable for use as the topsheet, more preferably carded polyproplylene fiber nonwoven such as the P-8 material described herein; and an elastic hip panel member **254** preferably comprising an elastomeric adhesive such as that described herein.

When the elastic hip panel member **254** is activated over its entire area, it is preferable to allow the portion of the stretch laminate **252** positioned axially below the absorbent core **28** to stretch to allow even better fit about the hips/buttocks of the wearer. This presents an issue in that the absorbent core **28** is typically not stretchable and would inhibit the stretch of the stretch laminate **252** in the zones where the absorbent core contacts the stretch laminate if it was conventionally joined to the stretch laminate. This is solved by either making the absorbent core stretchable or not attaching the absorbent core to the stretch laminate entirely or in discrete zones. In this latter approach, the absorbent core is allowed to "float" over the stretch laminate area by not securing portions or all of the absorbent core to the stretch laminate. For example, only the ends of the absorbent core are secured to the stretch laminate or specific zones are not attached by using a pattern of bonds such as spots, spirals, or stripes which provide intermittent bonding. In the first approach, the absorbent core can be made stretchable in a number of ways. For example, the absorbent core **28** can be mechanically stretched along with the stretch laminate **252** using the process as hereinbefore described. Thus, the absorbent core **28**, an elongatable component of the stretch laminate **252**, becomes stretchable by the mechanical stretching process. In this execution, the stretchable absorbent core preferably comprises a web of fibers comprising polypropylene fibers and superabsorbent fibers such as is described in U.S. patent application Ser. No. 07/915,133, "Stretchable Absorbent Articles" filed by Thomas W. Osborn, et al. on Jul. 23, 1992, the specification of which is incorporated herein by reference. The apparatus for stretching the overall laminate would preferably have a rib width of 0.030 inches, a pitch of 0.150 inches and a depth of 0.150 inches with an activation force of 33.3 g/in. Alternatively, the absorbent core itself can be made stretchable or elastically extensible such as is described in the Osborn application incorporated herein by reference.

In addition, it is preferred that the topsheet **24** of the diaper **220** also be stretchable. The topsheet **24** can be made stretchable by either using a stretchable topsheet material or activating selected portions or all of the topsheet by either passing the topsheet through the mechanical stretching apparatus prior to bonding the topsheet onto the diaper (mechanically prestraining the topsheet), or by mechanically stretching the topsheet in conjunction with the stretch laminate **252**. Preferred topsheets having stretchability are disclosed in U.S. patent application Ser. No. 07/915,133, "Stretchable Absorbent Articles" filed by Thomas W. Osborn, et al. on Jul. 23, 1992, and U.S. Pat. No. 5,037,416, "Disposable Absorbent Article Having Elastically Extensible Topsheet", which issued to Allen and Freeland on Aug. 6, 1991. Each of these references are incorporated herein by reference.

In a further alternative embodiment of the present invention, improved fit can also be achieved by an elongatable hip panel. In this embodiment, the hip panel can stretch but is not elastic. This nonelastic stretch is achieved by eliminating the elastic hip panel member from the laminate. Thus, only elongatable components are mechanically stretched to permanently elongate/deform the materials in this zone.

In another alternative embodiment, the elastic waist member **76** and/or the elastic side panel member **90** and the

elastic hip panel member **154** or **254** can be formed from a single piece or layer of elastomeric material. Thus, the elasticized hip panel **150** or **250** and the elasticized side panel **30** and/or the elasticized waistband **35** can be formed from the same piece of material.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. A disposable absorbent article having a first waist region, a second waist region having a central region and a side panel on each side of said central region, a longitudinal centerline, a lateral centerline, longitudinal edges, and end edges, the absorbent article having comprising:

a liquid pervious topsheet;

a liquid impervious backsheet joined to said topsheet;

an absorbent core having side edges and waist edges and being disposed between said topsheet and said backsheet;

an elasticized side panel disposed in each said side panel of said second waist region, each said elasticized side panel being elastically extensible in the lateral direction; and

an elasticized hip panel disposed in said central region of said second waist region at least longitudinally inwardly from said waist edge of said absorbent core toward said lateral centerline, said elasticized hip panel comprising a stretch laminate comprising a portion of said backsheet and an elastic hip panel member, at least a portion of said elastic hip panel member extending longitudinally outwardly from each said side edge of said absorbent core, said stretch laminate being mechanically stretched so that said backsheet is, at least to a degree, permanently elongated so as to not fully return to its original undeformed configuration such that said elasticized hip panel member is capable of elastically expanding beyond the original planar state of the absorbent article in at least the lateral direction to fit about the hips and buttocks.

2. The absorbent article of claim **1** wherein said stretch laminate is activated by mechanically stretching in the zones wherein said elastic hip panel member extends laterally outwardly from each side edge of said absorbent core.

3. The absorbent article of claim **1** wherein said stretch laminate is activated by mechanically stretching over the entire area of said elastic hip panel member.

4. The absorbent article of claim **3** wherein said absorbent core is stretchable to allow unencumbered expansion of said stretch laminate.

5. The absorbent article of claim **3** wherein said stretch laminate additionally comprises a portion of said absorbent core.

6. The absorbent article of claim **5** wherein said stretch laminate additionally comprises a portion of said topsheet.

7. The absorbent article of claim **5** wherein said elastic hip panel member comprises an elastomeric foam.

8. A disposable absorbent article having a first waist region, second waist region having a central region and a side panel on each side of said central region, longitudinal edges, and end edges, the absorbent article comprising:

a liquid pervious topsheet;

a liquid impervious backsheet joined to said topsheet;

an absorbent core having side edges and disposed between said topsheet and said backsheet;

an elasticized side panel disposed in each said side panel of said back waist region, each elasticized side panel being elastically extensible in the lateral direction;

an elasticized hip panel disposed in said central region of said second waist region, said hip elasticized hip panel comprising a stretch laminate comprising a portion of said backsheet, a laminate coversheet positioned between said backsheet and said absorbent core, and an elastic hip panel member disposed between said backsheet and said laminate coversheet, said elastic hip panel member extending longitudinally inwardly from said end edge of the absorbent article to about said longitudinal centerline and extending laterally outwardly from each said side edge of said absorbent core to about said elasticized side panel, said stretch laminate being mechanically stretched over the entire area of said elastic hip panel so that said backsheet and said laminate coversheet are, at least to a degree, permanently elongated so as to not fully return to their original undeformed configuration such that said elasticized hip panel is capable of elastically expanding beyond the original planar state of the absorbent article on at least the lateral direction; and

said absorbent core being unsecured to said stretch laminate in at least selected zones to allow unencumbered expansion of said stretch laminate.

9. The absorbent article of claim **8** wherein said topsheet is stretchable in at least said central region.

10. The absorbent article of claim **9** wherein said stretch laminate comprises a zero strain stretch laminate.

11. The absorbent article of claim **10** wherein said elastic hip panel member comprises an elastomeric adhesive.

12. The absorbent article of claim **11** wherein each said elastic panel member has a semi-elliptical shape.

13. The absorbent article of claim **12** wherein said absorbent core is unsecured to said stretch laminate over the entire area of said stretch laminate.

14. A disposable absorbent article having a first waist region, a second waist region having a central region and a side panel on each side of said central region, longitudinal edges, and end edges, the absorbent article comprising:

a liquid pervious topsheet;

a liquid impervious backsheet joined to said topsheet;

an absorbent core having side edges and waist edges, said absorbent core being disposed between said topsheet and said backsheet;

an elastic waist feature extending longitudinally outwardly from said waist edge of said absorbent core in said central region of said second waist region;

an elasticized side panel disposed in each said side panel of said second waist region, each said elasticized side panel being elastically extensible in the lateral direction; and

an elasticized hip panel disposed in said central region of said second waist region laterally outwardly from each said side edge of said absorbent core, laterally inwardly of said elasticized side panel, and longitudinally inwardly from said elastic waist feature, each said elasticized hip panel comprising a stretch laminate comprising a portion of said backsheet, a portion of said topsheet, and an elastic hip panel member positioned between said topsheet and said backsheet, each said stretch laminate being mechanically stretched so that said backsheet and said topsheet are, at least to a

degree, permanently elongated so as to not fully return to their original undeformed configuration such that each said elasticized hip panel is capable of elastically expanding beyond the original planar state of the absorbent article in at least the lateral direction.

15. The absorbent article of claim 14 wherein each said elasticized hip panel comprises a zero strain stretch laminate.

16. The absorbent article of claim 15 wherein each said elasticized side panel comprises a stretch laminate, said stretch laminate comprising a portion of said topsheet, a portion of said backsheet, and an elastic side panel member positioned therebetween, said stretch laminate being mechanically stretched.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,575,783
DATED : November 19, 1996
INVENTOR(S) : Sandra H. Clear, et. al.

It is certified that error appears in the above-Indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 15, line 18, delete "having".
Column 15, line 35, "longitudinally" should read -- laterally --.
Column 16, line 4, "back" should read -- second --.
Column 16, line 15, "longitudinal" should read -- lateral --.
Column 16, line 19, after "panel" insert -- member --.
Column 16, line 25, "on" should read -- in --.

Signed and Sealed this

Twenty-ninth Day of July, 1997

Bruce Lehman

Attest:

BRUCE LEHMAN

Attesting Officer

Commissioner of Patents and Trademarks

US005746732A

United States Patent [19]

Olsson et al.

[11] Patent Number: 5,746,732

[45] Date of Patent: May 5, 1998

[54] **ABSORBENT ARTICLES**

[75] Inventors: **Stefan Olsson**, Floda; **Urban Widlund**, Mölnlycke; **Anders Söderbergh**, Partille, all of Sweden

[73] Assignee: **Molnlycke AB**, Gothenburg, Sweden

[21] Appl. No.: **740,393**

[22] Filed: **Oct. 29, 1996**

Related U.S. Application Data

[63] Continuation of Ser. No. 256,448, filed as PCT/SE93/00055, Jan. 27, 1993 published as WO93/14729, Aug. 5, 1993, abandoned.

[30] **Foreign Application Priority Data**

Jan. 30, 1992 [SE] Sweden 9200259

[51] **Int. Cl.**^{6} **A61F 13/15**

[52] **U.S. Cl.** **604/385.2**; 604/385.1

[58] **Field of Search** 604/385.1-387, 604/397-399, 373

[56] **References Cited**

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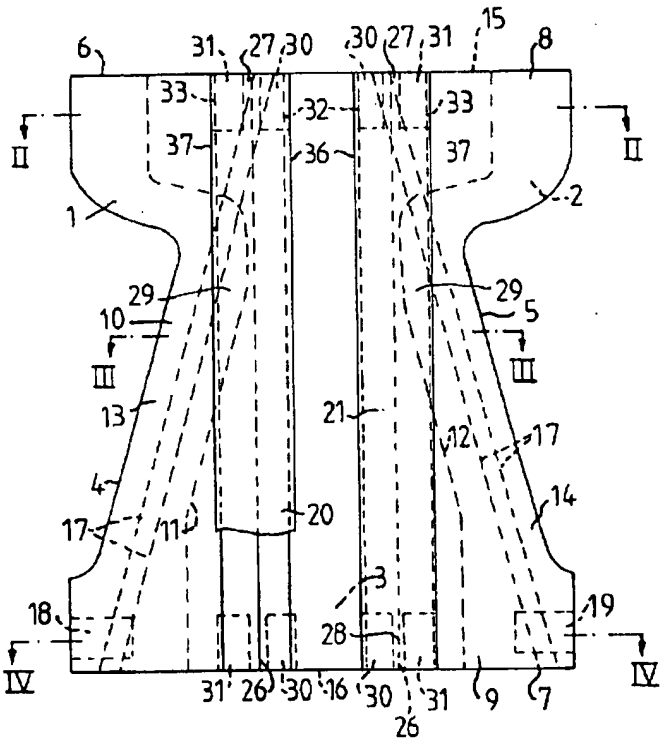
Primary Examiner—Debra S. Brittingham
Assistant Examiner—K. M. Reichle
Attorney, Agent, or Firm—Young & Thompson

[57] **ABSTRACT**

An absorbent article for one-time use only, such as a disposable diaper, incontinence guard, sanitary napkin, panty protector or the like, includes at least one hose-like fold (**20**, **20'**, **21**, **21'**) which extends in the transverse and/or longitudinal direction of the article. Mounted in the fold (**20**, **20'**, **21**, **21'**) are mutually spaced elastic elements (**32**, **32'**, **33**, **33'**) which are fastened to respective end parts (**27**, **27'**, **28**, **28'**) of the fold on respective sides of fold lines (**24**, **25**) which depart from the upper casing layer (**1**) of the article, although these elastic elements (**32**, **32'**, **33**, **33'**) are freely moveable in the intermediate part (**29**, **29'**) of the fold. The end-parts (**27**, **27'**, **28**, **28'**) of the fold are joined to the upper casing layer (**1**) in a flat, permanently down-pressed state, whereas the intermediate fold part (**29**, **29'**) is forcibly lifted vertically by the action of the elastic elements (**32**, **32'**, **33**, **33'**) as the article is fitted to the wearer and consequently curved, so as to form leakage barriers along the side edges and/or the end edges (**4-7**) of the article.

13 Claims, 4 Drawing Sheets



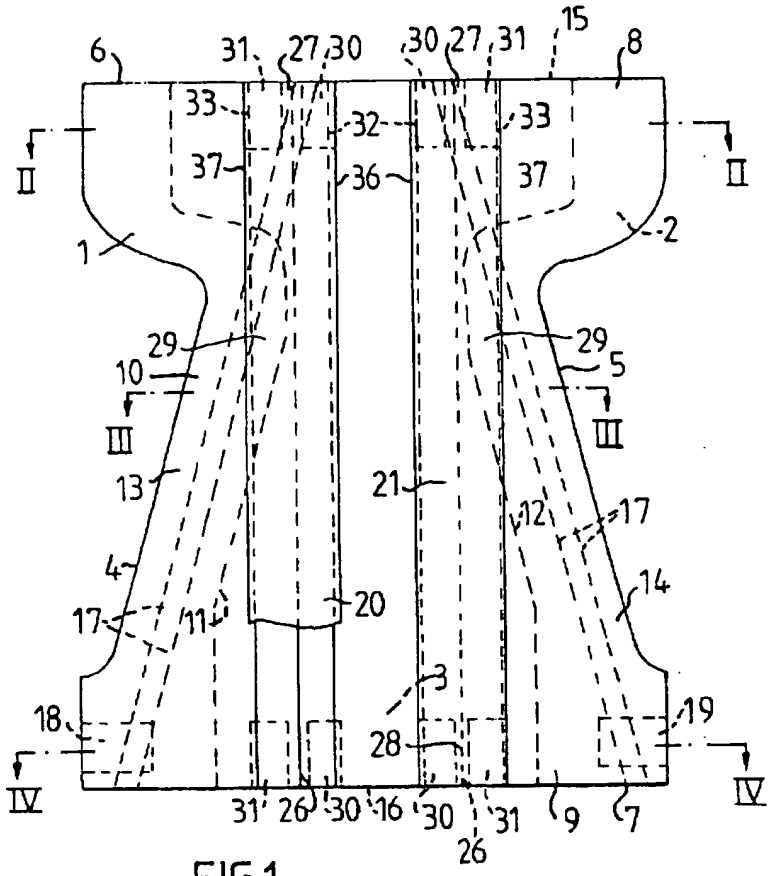


FIG.1

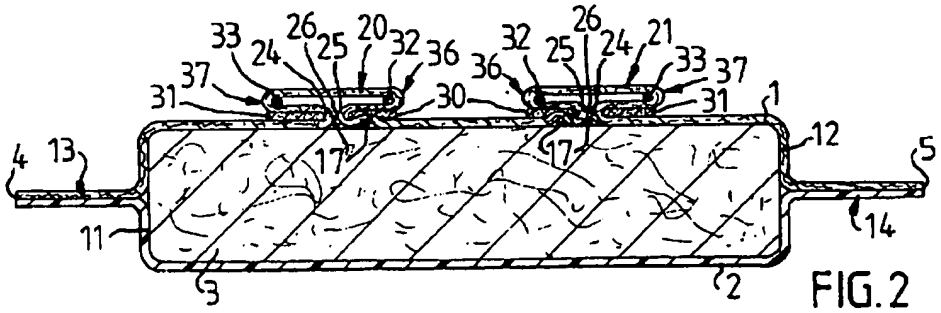


FIG. 2

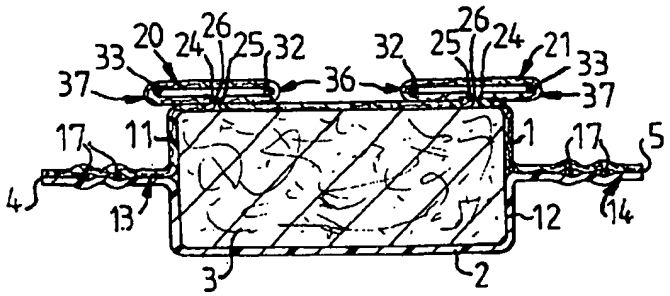


FIG. 3

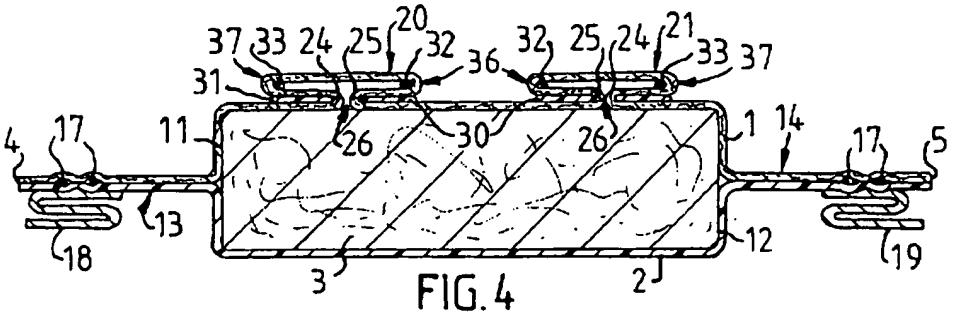


FIG. 4

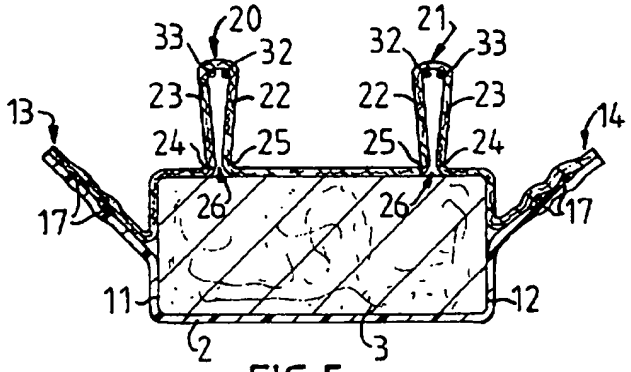


FIG. 5

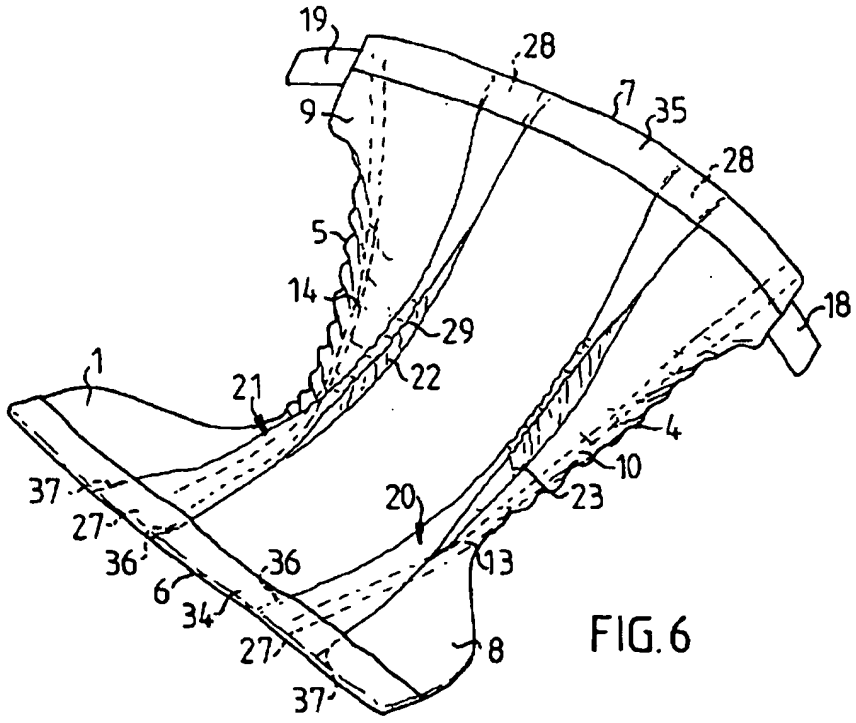


FIG. 6

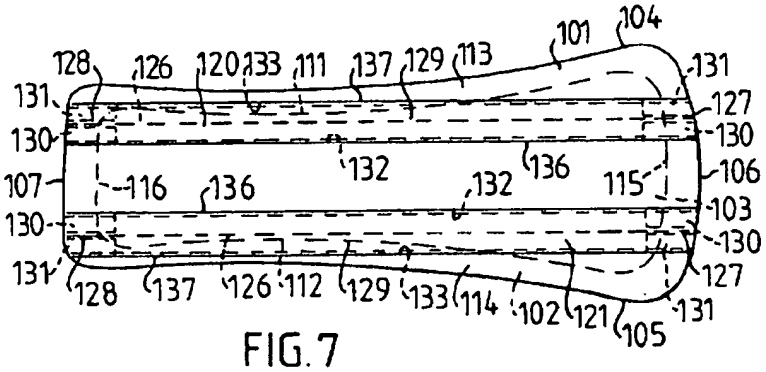


FIG. 7

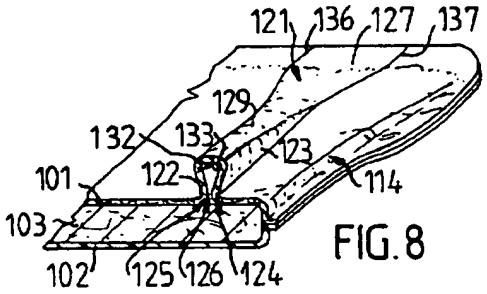


FIG. 8

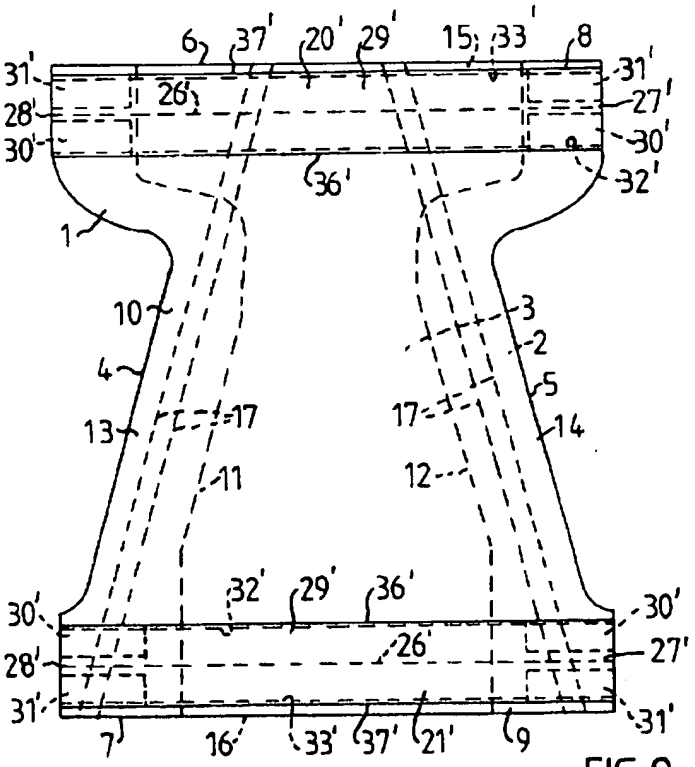
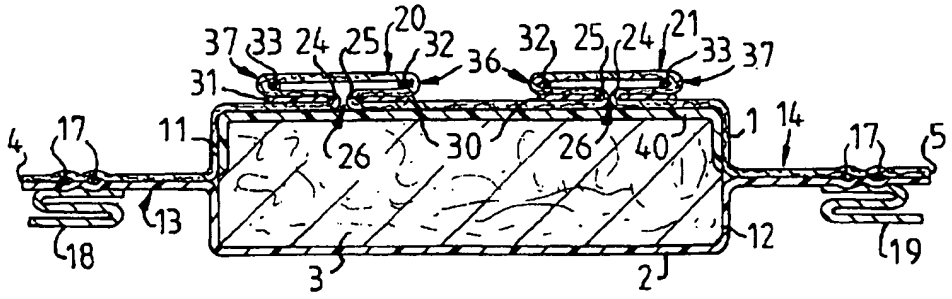


FIG. 9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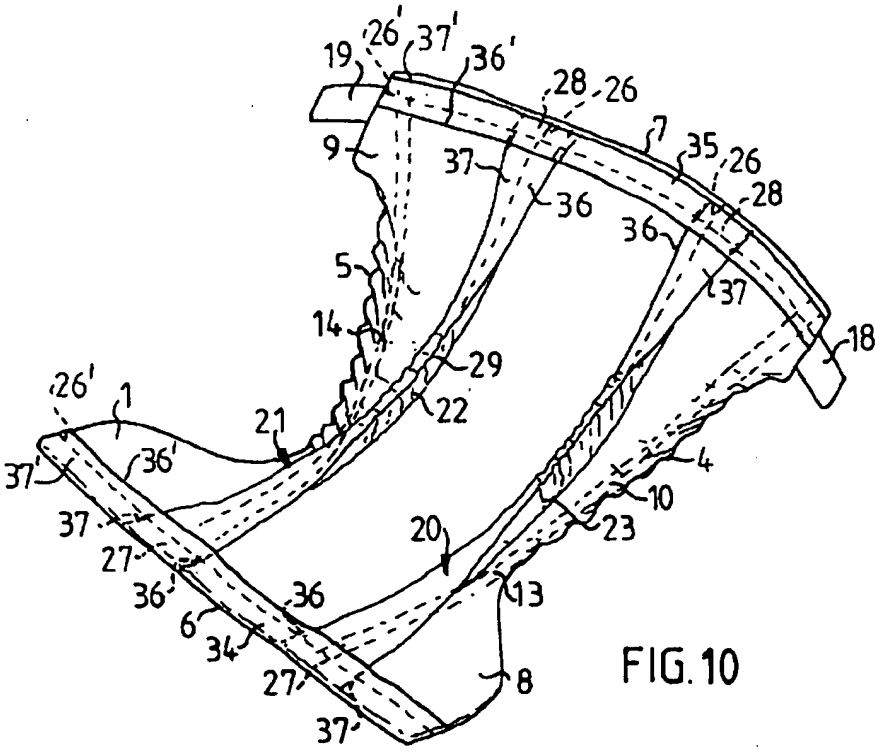
31
4 17 11 26 30 26 40 1 14 17 5
13
18
3
2
12
19

FIG. 11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9 37 36 7 35 26 28
36
5 37
14 29 18
26' 1 22
21
37' 36' 4
37 10
27 20 23
36' 36 13
6 34
27' 8
37'

FIG. 10

ABSORBENT ARTICLES

This application is a continuation of application Ser. No. 08/256,448, field Jul. 13, 1994, now abandoned; which is the 35 U.S.C. §317 National Stage of International Application Serial No. PCT/SE93/00055, filed Jan. 27, 1993, and which published as WO93/14729 on Aug. 5, 1993.

FIELD OF THE INVENTION

The present invention relates to a disposable absorbent article, such as a diaper, an incontinence guard, a sanitary napkin or a panty guard, comprising an absorbent pad which is embraced between a liquid-permeable upper, or inner casing layer which is intended to face towards the wearer in use, and an outer casing layer, or backing layer, which is intended to lie distal from the wearer in use, and further comprising elastication.

BACKGROUND OF THE INVENTION

The absorbent pads of such absorbent articles are intended to take-up body fluids discharged by the wearer. One problem with earlier known absorbent articles, such as diapers, is that large quantities of fluids are discharged over very short periods of time and that these large fluid quantities are unable to penetrate the liquid-permeable casing layer quickly enough. Another problem is that excrement is often not able to penetrate through the casing layer at all, unless special measures are taken to this effect. As a result, excrement, and at times also urine, remains in a receiving zone on top of the diaper, between the inner casing layer and the user, which can naturally lead to a number of problems and cause discomfort to the wearer. This liquid and excrement, particularly loose excrement, will float uncontrollably on top of the inner casing layer and travel along the simplest route under the influence of gravity, and sooner or later the liquid or the loose excrement will run out over the edges of the diaper, therewith soiling the clothes or bed linen of the wearer, to the great disadvantage of both the wearer, parents or nursing personnel. The liquid and/or excrement is able to escape at the end edges and side edges of the diaper, depending on the position of the wearer's body at the time, although such leakage, or seepage, will take place primarily at the side-edges of the diaper. That part of the diaper which lies between the wearer's thighs, the so-called crotch part, is particularly restricted laterally, and consequently the urine and excrement has only a very short distance to travel to the side edges of the diaper. It will be understood that the risk of leakage from the diaper edges is particularly great when the wearer lies on his/her side and large quantities of urine or loose excrement are discharged suddenly. Edge leakage is also a problem in articles which are intended to absorb menstruation fluid, such as sanitary napkins, since such articles are very narrow, so that they can be worn discretely and comfortably. It is known to guard against discomfort caused by this type of edge leakage, by mounting elongated elastic devices, in the form of elastic threads, bands or the like, in readily flexible side flaps provided externally of the side edges of the absorbent pad, so that the side flaps will conform sealingly to the wearer's thighs. See for instance Swedish Patent Specification 7905765-9 and European Patent Application EP 0 091 412. The side flaps are often comprised of parts of the casing layer and extend, at least laterally, beyond the edges of the absorbent pad, where they are mutually joined.

It is also known from British Patent Specification 2,161,059 A to arrange narrow folds in the inner casing layer nearest the wearer. The folds are formed in the casing layer and depart from a longitudinally extending base line, wherein the mutually opposing sidewalls of the fold are mutually joined along the full length of the fold. Mounted within the fold are elastic devices which are intended to elevate the folds, up and away from the surface of the casing layer. The two end parts of the fold, at respective end parts of the diaper, are folded laterally inwards towards the center of the diaper and there secured to the casing layer. EP 0 311 333 A2 teaches a "floating" region of a casing layer at respective side edges of a diaper, this region being delimited laterally by two joins, an outer and an inner join, between which the casing layer is unattached to the material located beneath the casing layer. These joins are mutually spaced, so that the "floating" region will have a given width. Disposed in this "floating" region is an elastic device whose ends are attached to the casing layer, while the intermediate part of said device is free from at least the underlying layer, thereby enabling the elastic device to "float" freely in said "floating" region and, at the same time, lift the casing layer within said region.

GB 2,216,393 A teaches a diaper which has barrier flaps that extend along the side edges of the diaper. The barrier flaps have a main part which extends up from the diaper, an inner crotch part which extends from said main part in towards the diaper, and an outer crotch part which extends from said main part away from the diaper. Both of the crotch parts include elastic elements which ensure that said parts will seal elastically against the wearer. In the case of the illustrated embodiment, the main part of the barrier flaps is comprised of at least two mutually abutting layers. Each of the crotch parts branches in a respective direction at the uppermost part of the main barrier part, therewith imparting a T-shape or Y-shape to the barrier flaps. It is intended that the elastication shall lie against the inside of the wearer's thighs instead of chaffing the wearer's crotch. These narrow folds, or "floating" regions of the casing layer are, however, encumbered with drawbacks. For instance, a narrow fold configured in accordance with GB 2,161,059 can be readily deflected laterally and flattened against the casing layer, so that the fold will no longer assist in protecting against leakage, therewith allowing liquid to run over the flattened fold. Because the two end parts of the fold are folded laterally and inwardly, the elastic elements will always be located laterally inwards of the base line of the fold, therewith impairing the elastic sealing effect of the fold. In practice, the tension required in the elastic elements to enable said elements to raise the fold vertically from its position on one side of the base line is so great as to render it particularly uncomfortable to the wearer. On the other hand, less tension or stretch in the elastic elements would result in a significant risk of gaps appearing between the folds and the wearer's skin, since the tension would not then be sufficient to lift the fold from its horizontal starting position. The space between the folds is also limited, because the folds are both oriented in a direction inwardly of the diaper, thereby enabling urine or excrement to collect outside the folds instead of inwardly thereof. For reasons of a trigonometrical nature, the "floating" region where the joins are spaced from one another, as described in EP 0 311 333, does not obtain a sufficiently high height and does not therefore provide a sufficiently effective barrier against leakage within the crotch area, where the risk of leakage is particularly great and where the highest possible and most stable leakage barrier is desired.

Thus, there is a need for improved protection against edge leakage in absorbent articles such as diapers, incontinence guards and sanitary napkins.

SUMMARY OF THE INVENTION

In accordance with the invention, an absorbent article of the kind defined in the introduction is characterized in that the article includes on both sides of a central receiving zone, a hose-like fold which is comprised of a pliable or flexible material layer which extends in the longitudinal direction of the article on that side thereof which is intended to face the wearer in use, such as to form leakage barriers; in that each fold has a first and a second end part and an intermediate part, two first fold lines from which the fold departs and which extend in the longitudinal direction of said fold, said first fold lines being close to one another and coinciding essentially with a common base line; in that the fold extends laterally outwards away from the base line in both directions; in that two elastic elements, such as elastic threads, bands or the like, are mounted within the hose-like fold in a pre-stretched state and along said fold, one element on each side of the base line; in that the two end parts of the fold are planar and have a maximum lateral extension and are terminated at second fold lines on each side of said base line, wherein respective elastic elements extend along said second fold lines; in that said end parts of the fold are joined to the liquid-permeable upper casing layer in a flat, permanently down-pressed state; in that the elastic elements are joined to the fold along said second fold lines at the end parts of the fold; in that the intermediate part of the fold and the elastic elements extending therethrough are freely moveable whereby in the extended, flat state of the article, the hose-like fold is flat, including also the intermediate part of said fold, with each of the two elastic elements located on a respective side of the base line, and whereby, when the article is placed on the user and therewith forcibly curved to conform to the wearer's body, the intermediate part of the fold will lift vertically as a result of the action of the elastic elements, so as to form said leakage barriers.

In another embodiment of the invention, the hose-like folds are disposed in the transverse direction of the article, preferably close to respective end edges of the article.

In one preferred embodiment of the invention, two elastic elements are mounted within a longitudinally extending fold in mutually spaced relationship, wherein the distance between said elements is equal to the width of the fold at its respective end part. The elastic elements are attached to the pliable material layer at respective end parts of the fold, these end parts, in turn, being attached to the casing layer so as to maintain the spacing of said elements at their respective end parts. When the diaper is curved in use to a generally U-shape, as seen from one side of the diaper, the elastic elements will successively approach one another in a direction from respective end parts to a region approximately central between the end parts, where the elastic elements may even coincide. The fold also narrows successively in the same direction, while, at the same time, progressively lifting vertically, away from the surface of the casing layer, and has its narrowest and its highest part in the same region, approximately centrally of the end parts, as those regions in which the elastic elements lie closest together or coincide. Thus, the fold has its greatest height approximately centrally of its two end parts, which in the case of a fold disposed along the side edges of the diaper lies in the crotch part of the diaper where the need for the highest possible barrier is greatest. This height is essentially equal to the width of the end parts of the fold where the elastic elements coincide. The high narrow fold widens successively from this region towards the end parts of the fold, since the elastic elements strive to separate laterally, one from the other, while the height of the fold decreases successively at the same time. Because the end parts of the elastic elements are attached at some considerable distance apart and on respective sides of the base line, the fold will obtain considerable resistance to lateral deformation. One important advantage afforded by the inventive construction is that the barrier will lift vertically along substantially the whole of its length as the article is curved while fitting the same to the wearer, which is not always the case with earlier known constructions. Another advantage is that because the fold is relatively wide over a comparatively large part of its length, the fold will lie softly and comfortably against the skin of the wearer. The use of more than one elastic element also enables the elements to be tensioned to a lesser extent than when only one element is used, which is beneficial from the aspect of wearer comfort. It will be understood that more than two elastic elements can be mounted within the tunnel fold, wherein the distance between the two outermost elements is equal to the width of the fold at the end part thereof. The provision of several elastic elements also greatly increases the degree of wearer comfort.

An essential feature of the invention is that the sidewalls of the fold are not connected with one another and that the elastic elements are solely connected to the end parts of the fold and to no other part thereof. One reason for this is that binding agents tend to impart stiffness and hardness to the fold and therewith possibly causing discomfort to the wearer. In unfavourable cases, the binder may also penetrate the fold material and bond the fold to the casing layer, thereby preventing the fold from lifting in the manner intended.

Another reason is because an "airy" fold and a fold that can breathe is desired, so as to enhance wearer comfort. The presence of an air-filled tunnel between the inner and the outer sidewalls of the fold enables the outer sidewall to function as a leakage barrier independently of the inner sidewall. Thus, liquid is forced to pass the inner sidewall and the corridor between said sidewalls before reaching the outer sidewall.

The end parts of the fold extend laterally both inwardly of and outwardly of the base line, and one elastic element is attached outwardly of the base line and the other element inwardly thereof. By arranging parts of the fold and an inner elastic element inwardly of the base line at the front and the rear parts of the article, there is obtained in the intermediate part of the fold a kind of collecting pocket or channel between the casing layer and the inner sidewall of the fold. This pocket is oriented inwardly of the diaper and extends in the longitudinal direction of the fold, to the region located generally centrally between the end parts of the fold, where the fold is narrowest and highest.

Furthermore, advantages are obtained by disposing parts of the fold and an outer elastic element outwardly of the base line at the front and the rear parts of the article respectively. For instance, the distance between the folds arranged at respective side edges of the article is larger than when the whole of the fold extends inwardly of the base line. This latter case would greatly restrict the urine-receiving and excrement-receiving surface between the two folds. In this context, the outer elastic element functions as a counterbalance to the inner elastic element, which strives to move the fold inwardly of the article from its attachment part inwardly of the base line, whereas the outer elastic element strives to move the fold in the opposite direction from its attachment part outwardly of the base line. Thus, the two elastic elements coact to give the fold its shape, which varies from a wide, low fold at the front and the rear parts of the article

to a successively narrower and higher fold, the closer the fold approaches the center point between the two end parts of the fold. Seen from above, the fold describes a longitudinally extended X, i.e. the side edges of the fold are arcuate and curve in opposite directions towards each other.

When the two attachment parts of the two elastic elements are spaced equidistant from the common base line at the end parts of the fold and on opposite sides of the base line, the elastic sealing effect of the fold against the skin of the wearer will act in a vertical direction relative to the plane of the casing layer and immediately above the common base line, where the fold has a zero angle of inclination. As a result, the fold will move resiliently vertically up or down, depending on whether the wearer increases or decreases the pressure exerted on the fold. When the wearer causes the pressure on the fold to increase, the fold will be compressed slightly while widening at the same time, such as to obtain a generally triangular shape, with the base of the triangle facing upwards. The fold is therefore not deformed in any disadvantageous manner, and contact with the wearer's skin will be maintained during this downward movement of the fold. When the pressure exerted by the wearer decreases, the fold moves resiliently upwards while narrowing at the same time and therewith increasing the height of the fold, so as to maintain abutment with the skin and also fulfilling its function as a leakage barrier.

Although it is preferred to attach equally large end parts of the fold both inwardly and outwardly of the common base line, so as to able to obtain a maximum fold height and a favourable resilient sealing effect immediately above the common base line, it is conceivable to displace the end parts of the fold laterally in relation to the base line. In the case of folds which are disposed along the end edges of an article, it may be beneficial, for instance, when greater parts of the fold extend inwardly of the base line than outwardly thereof, so as to obtain the largest possible pocket. The requirement of sufficient distance between the folds is, after all, satisfied in that articles such as diapers are often elongated and in that the end edges of the article are therewith located at a safe distance from one another. In the case of articles in which the folds are provided along the side edges thereof, it may be advantageous, for instance, to permit the end part of the fold in the front part of the article to extend laterally with parts of different sizes inwardly and outwardly of the base line, i.e. to permit different sized parts of the inner sidewall and of the outer sidewall to be attached to the casing layer, while in the rear part of the article permitting larger parts of the fold to extend outwardly of the base line than inwardly thereof, so as to create the widest possible space between the folds at said rear part of the article.

Because the fold has a hose-like form and because the intermediate part of the elastic elements located between the points at which the element is attached to respective end parts of the fold is able to move freely both laterally and vertically, the fold can be oriented in a direction suitable for the purpose intended, by displacing the fold in relation to the common base line when fastening the end part of the fold to the casing layer, without needing to change the width of the fold to any appreciable extent or to allow the base line to describe a non-linear curve. For instance, there may be provided a base line which extends totally in the longitudinal direction of the article, while displacing the end parts of the fold laterally to an appropriate extent and still obtain a fold which extends obliquely in relation to the longitudinal axis of the article, without needing to encroach on the width of the fold at said parts. This will afford a high degree of flexibility in manufacture, since articles such as diapers are produced in a large number of sizes and shapes, all of which require their particular variant of the pattern formed by two folds, for instance along respective side edges of the diaper, in order for the diapers to function effectively, both with regard to body conformity and proof against leakage. With regard to manufacture, an advantage is gained when a linear base line extends parallel with the longitudinal axis or transverse axis of the article, this arrangement being preferred, although not necessary, since the articles are produced at a very high rate of manufacture and process steps which are performed parallel with the direction of the manufacturing line are often the most suitable from a process/technical aspect. It will be understood, however, that in spite of this, it is conceivable in some instances for the base line to be angled slightly in relation to the longitudinal or transversal axis of the article, when considered appropriate. It will be also understood that inventive longitudinally and transversely extending folds can be combined, therewith providing around all edges of the article barriers which fully circumvent the liquid-and-excrement-receiving area inwardly of the folds.

BRIEF DESCRIPTION OF THE DRAWINGS

An absorbent article construction in accordance with the invention will now be described with reference to an exemplifying embodiment thereof illustrated in the accompanying drawings, in which

FIG. 1 illustrates a diaper from above and from that side which is intended to face towards the wearer in use, and shows the elastic elements in a stretched state, parts of one fold have been omitted from the illustration for the sake of clarity;

FIG. 2 is a cross-sectional view of the diaper shown in FIG. 1, taken on the line II—II;

FIG. 3 is a cross-sectional view of the diaper shown in FIG. 1, taken on the line III—III;

FIG. 4 is a cross-sectional view of the diaper shown in FIG. 1, taken on the line IV—IV;

FIG. 5 is a cross-sectional view of the diaper shown in FIG. 1, taken on the line III—III, but with the elastic elements shown contracted from their stretched state;

FIG. 6 is a perspective view of a diaper with the elastic elements contracted from their stretched state;

FIG. 7 shows a sanitary napkin from above, with the elastic elements in a stretched state, said view being taken from the side which is intended to face towards the wearer in use;

FIG. 8 is a perspective view of part of the napkin shown in FIG. 7, illustrating a section of a fold in which the elastic elements have contracted from their stretched state;

FIG. 9 illustrates from above a diaper according to another embodiment, with the elastic elements in a stretched state, said view being taken from the side which is intended to face towards the wearer in use;

FIG. 10 is a perspective view similar to FIG. 6 of a diaper having fold which extend to different extents with respect to base line; and

FIG. 11 is a cross-sectional view similar to FIG. 4 of a diaper having an additional casing layer between the upper casing layer and the absorbent pad.

DETAILED DESCRIPTION OF THE INVENTION

The diaper illustrated in FIG. 1 includes a liquid-permeable casing layer 1, a liquid-impermeable casing layer

2 and an absorbent pad 3 placed between said layers 1 and 2. The liquid-permeable casing layer 1 is placed on that side of the diaper which is proximal to the wearer in use and is comprised, for instance, of a pliable, non-woven fabric. The liquid-impermeable layer 2 is placed on the opposite side of the diaper and is comprised, for instance, of a polyethylene sheet. The absorbent pad comprises, for instance, cellulose fluff fibres or other absorbent fibres. The absorbent pad may also include so-called super-absorbents, i.e. substances whose absorbency is many times that of the substances' own weight. The super-absorbents may be comprised of polymers, such as cross-linked polyacrylates, and may be present in the form of flakes, granules, powder or fibres. The super-absorbents and the cellulose fluff fibres may be mixed together in the absorbent pad in a greater or lesser homogenous state, or the super-absorbents may, alternatively, be arranged in layers in the absorbent pad. The absorbent pad may be constructed of one or more absorbent layers which vary individually with regard to material composition, size, density, surface weight, etc. For the sake of simplicity, the absorbent pad 3 of the illustrated embodiment is shown as one single layer.

The illustrated diaper has two side edges 4, 5, two end edges 6, 7, a front part 8 which is intended to lie forwardly of the wearer in use, a back part 9 which is intended to be located rearwardly of the wearer in use, and a crotch part 10 located between the front and the back parts 8, 9 of the diaper. Both the diaper and the absorbent pad 3 have a modified T-shape, with the transverse limb of the T being located in the front part 8 of the diaper.

The two casing layers 1, 2 extend laterally beyond the side edges 11, 12 of the absorbent pad, where they are joined together to form side flaps 13, 14. The two casing layers 1, 2 are joined together at the end edges 6, 7 of the diaper without forming a corresponding end flap, by folding the liquid-impermeable layer 2 around the end edges 15, 16 of the absorbent pad 3 and slightly in over said pad and in beneath the liquid-permeable casing layer 1, in a manner not shown. The two casing layers 1, 2 are joined together in a conventional manner, for instance with the aid of an adhesive, or by heat-sealing or ultrasonic welding processes.

Elastic elements in the form of two pre-stretched elastic threads 17 are provided in respective side flaps 13, 14 extending from the back part 9 to the front part 8 of the diaper. Elastic bands, foamed material, film and like material may conceivably be used instead of elastic threads. The elastic threads 17 extend in over the absorbent pad 3 at the front part 8 of the diaper, therewith departing from the side flaps 13, 14. The elastic threads 17 in the two side flaps 13, 14 together form a V-shaped pattern, with the apex of the V located on the front part 8 of the diaper.

A pair of fastener tabs 18, 19 are provided on respective side edges 4, 5 of the back diaper part 9 in a conventional manner, these fastener tabs enabling the back diaper part 9 to be fastened to the front diaper part 8 after the diaper has been placed on the wearer.

Two folds 20, 21 in the liquid-permeable casing layer 1 are arranged along the side edges 4, 5 of the diaper. The folds have a hose-like or tubular configuration, and each has an inner sidewall 22 and an outer sidewall 23. The inner sidewall 22 faces in towards the diaper and the outer sidewall 23 faces out away from the diaper in the raised or elevated state of the fold, as will best be seen from FIG. 5.

Each inner and outer sidewall 22, 23 departs from a respective fold line 25, 24 in the liquid-permeable casing layer 1, these fold lines 24, 25 being placed so close together as to essentially coincide to form a longitudinally extending base line 26 which is common to the fold 20, 21. This common base line 26 is located inwardly of respective side edges 11, 12 of the absorbent pad and extends in a generally straight line from one end edge 6 of the diaper to the other end edge 7 thereof.

The fold 20, 21 also has two end parts 27, 28 and an intermediate part 29. The width of the fold 20, 21 is essentially equally as large at the end parts 27, 28 and the intermediate part 29. The two end parts 27, 28 are attached to the liquid-permeable casing layer 1 in lateral attachment regions 30, 31 both inwardly and outwardly of the common base line 26, and are delimited laterally by respective second fold lines 36, 37. The end parts of the fold may be bonded to the casing layer with the aid of an adhesive, or attached thereto by ultrasonic welding, heat-sealing or some other process suitable for the purpose intended.

Since the fold 20, 21 has the same width over the whole of its length and the common base line 26 extends in the direction of the long axis of the diaper, parts of the inner sidewall 22 and the outer sidewall 23 of the fold will be attached to the casing layer 1, the inner sidewall 22 being attached inwardly of the common base line 26 in attachment region 30 and the outer sidewall 23 being attached outwardly of the common base line 26 in attachment regions 31. The fold 20, 21 is displaced laterally, so that those fold parts which are attached outwardly of the common base line 26 will be generally the same size as those parts which are attached inwardly of said common base line. As best seen in FIG. 10, the fold 20, 21 may however extend laterally to different extent in both directions from the base line at least at one end part of the fold. However, for reasons of a process/technical nature, it is conceivable for the width of the fold 20, 21 at the end parts 27, 28 to be somewhat smaller when joining the end parts 27, 28 to the liquid-permeable casing layer 1, for instance due to unintentional crumpling or creasing of the fold sidewalls.

Two elastic elements 32, 33, for instance in the form of pre-stretched elastic threads, bands or the like, are mounted within the fold 20, 21. The elastic elements 32, 33 are attached to the end parts 27, 28 of the fold 20, 21, for instance with the aid of an adhesive, but are free to move in relation to the fold 20, 21 and in relation to each other in the intermediate part 29 of the fold. Neither are the inner and the outer sidewalls 22, 23 joined together at this intermediate part 29 of the fold. The elastic elements 32, 33 within the fold 20, 21 are also spaced apart at a distance which is equal to the width of the end part 27, 28 of the fold, i.e. at respective second fold lines 36, 37. When the diaper is extended, i.e. in the manner shown in FIG. 1, the elastic elements 32, 33 extend parallel with one another along respective second fold lines 36, 37 along the full length of respective folds 20, 21. The greater the distance between the elastic elements 32, 33 at the end parts 27, 28 of the fold, the farther the elastic elements 32, 33 are spaced from one another along the fold 20, 21 before said elements 32, 33 merge with one another and raise the fold 20, 21 to its maximum height in the crotch part 10 of the diaper when curving the diaper in order to place it around the wearer's body. This enables the fold to be stretched so as to exhibit width and stability in the front part and back part 8, 9 of the diaper. It is conceivable, of course, that because of process/technical reasons, the elastic elements 32, 33 will not be positioned exactly at the maximum distance afforded by the width of the fold, although deviations of one or two millimeters can be considered immaterial, since the fold has a width of at least two centimeters. The most important

criterion is that the elastic elements are spaced at the greatest possible distance from one another.

FIGS. 2–4 are cross-sectional views of the diaper shown in FIG. 1 at three different positions, i.e. in the front part 8, the crotch part 10 and the back part 9 of the diaper respectively. The illustrated size ratios between the different widths, lengths and thicknesses of the illustrated structural elements may appear to be disproportionate in several instances. This is because these parameters have been either enlarged or reduced for the sake of clarity.

FIG. 2 illustrates how the two folds 20, 21 are fastened to the liquid-impermeable casing layer 1 relative to the common base line 26 in respective fastening regions 30, 31. FIG. 2 also shows the positioning of the elastic elements 32, 33 within respective end parts 27 of the fold. The elastic elements 17 extend along the side edges of the diaper and are attached inwardly of respective side edges 11, 12 of the absorbent pad in the front part 8, between said pad and the liquid-permeable casing layer 1. The elastic element 17 extend from the front part 8 of the diaper in a direction towards the back part 9 thereof and parallel with the obliquely cut parts of the diaper side edges 4, 5 in the crotch part 10, wherein the elastic element 17 from the crotch part 10 and rearwards are attached in the side flaps 13, 14, as illustrated in FIGS. 3 and 4. It will also be seen from FIG. 3 that when the elastic elements 17, 32, 33 are stretched, the folds 20, 21 will extend slightly outside respective side edges 11, 12 of the absorbent pad, since the crotch part 10 of the pad 3 is narrower at the crotch part 10 than at the front and back parts 8, 9 of the diaper. FIG. 4 shows that, in principle, the two folds 20, 21 are fastened at the back part 9 in the same manner as at the front part 8. FIG. 4 also shows fastener tabs 18, 19 attached to the outer surface of the liquid-impermeable backing layer 2, in a Z-folded configuration.

When the elastic elements 17, 32, 33 contract from their stretched state, the two folds 20, 21 of the diaper will lift in the crotch part 10, as shown in FIG. 5. The section shown in FIG. 5 is taken at the same place as the section shown in FIG. 3. FIG. 5 shows that in this state of the diaper, the two elastic elements 32, 33 have moved together, so as not to be spaced apart in this region of the diaper and at that moment in time. Contraction of the elastic element 17 also causes the side flaps 13, 14 to be curved upwards, as will also be seen from FIG. 5.

FIG. 6 is a perspective view of an inventive diaper. The manner in which the end parts 27, 28 of the folds are attached differs in the case of the diaper according to the FIG. 6 embodiment, although in other respects the diaper is identical to the diaper shown in FIG. 1.

FIG. 6 shows how the folds 20, 21 narrow down from their respective end parts 27, 28 in a direction towards the intermediate part 29, while rising vertically above the common base line 26 at the same time. A tape 34, 35 is placed along the respective end edges 6, 7 of the diaper, over the liquid-permeable casing sheet 1 and over respective end parts 27, 28 of the folds. The tape 34, 35 functions to hold the end parts 27, 28 of the folds in a flattened and extended state against the casing layer 1.

FIGS. 7–8 illustrate a sanitary napkin constructed in accordance with the invention. The illustrated sanitary napkin includes a liquid-permeable casing layer 101, a liquid-impermeable casing layer or back sheet 102, and an absorbent pad 103 placed between the two casing layers 101, 102. The liquid-permeable casing layer 101 is placed on that side of the napkin which is intended to face towards the wearer in use and is comprised, for instance, of a non-woven fabric or a perforated plastic film. The liquid-impermeable layer 102 is comprised, for instance, of a plastic film or a non-woven fabric which has been made hydrophobic. The absorbent pad 103 may comprise one or more layers of absorbent material, for instance cellulose fluff with or without admixture with superabsorbents. In FIG. 8, the absorbent pad 103 is shown to comprise only one single layer.

The illustrated napkin has two side edges 104, 105 and two end edges 106, 107. The two casing layers 101, 102 extend beyond the edges 111–112, 115–116 of the absorbent pad and are there joined together and form side flaps 113, 114. The casing layers 101, 102 are conveniently joined together with the aid of some known technique, for instance as by gluing, heat-welding or ultrasonic welding. The liquid-permeable casing layer 101 has two folds 120, 121 which extend along the side edges 104, 105 of the napkin. These folds are shown in a flat, extended state in FIG. 7. As will best be seen from FIG. 8, the folds have a tubular or hose-like configuration and when raised present an inner sidewall 122 and an outer sidewall 123. The inner sidewall 122 faces in towards the napkin and the outer sidewall 123 faces outwardly of the napkin.

Each of the inner and outer sidewalls 122, 123 extends from a respective fold line 124, 125 on the liquid-impermeable casing layer 101, these fold lines 124, 125 being located so close together as to essentially coincide to form a common, longitudinally extending fold base line 126. The common base line 126 is arranged inwardly of respective side edges 111, 112 of the absorbent pad and extends in an essentially straight line, from one end edge 106 of the napkin to the other end edge 107.

The fold 120, 121 also has two end parts 127, 128 and an intermediate part 129, and has essentially the same width at both end parts 127, 128, and in the intermediate part 129. The two end parts 127, 128 are attached to the liquid-permeable casing layer 101 in lateral attachment regions 130, 131 both inwardly and outwardly of the common base line 126 and are flattened against the casing layer 101 at said end parts 127, 128, such as to define the fold laterally by respective second fold lines 136, 137. The end parts of the fold can be secured, for instance, with the aid of an adhesive, or by an ultrasonic welding process, a heat-sealing process or by some other process suitable to this end.

Since the fold 120, 121 has the same width over the whole of its length and since the common base line 126 extends in the longitudinal direction of the napkin, parts of the inner sidewall 122 and of the outer sidewall 123 will be fastened to the casing layer 101, the inner sidewalls 122 in the attachment regions 130 inwardly of the common base line 126 and the outer sidewall 123 in the attachment regions 131 outwardly of the common base line 126. The fold 120, 121 is displaced laterally, so that those parts of the fold 120, 121 which are secured outwardly of the common base line 126 will be roughly the same size as those fold parts which are secured inwardly of the common base line 126.

Two elastic elements 132, 133, for instance pre-stretched elastic threads, bands or the like, are mounted within the fold 120, 121 in the same manner as that described with reference to the diaper illustrated in FIGS. 1–6.

FIG. 8 shows that the elastic elements 132, 133 approach each other within the fold 121, so as to coincide in a region of the intermediate fold part 129. The fold is wide and low at its end part 127, but rises and tapers off in a direction towards the intermediate part 129. The fold 121 therewith forms a high, stable, comfortable and resilient sealing barrier

which effectively counteracts leakage of menstruation fluid over the side edges of the napkin.

FIG. 9 illustrates an embodiment of the invention in which the hose-like folds 20', 21' are arranged in the transverse direction of a diaper instead of in its longitudinal direction. The diaper shown in FIG. 9 and the folds 20', 21' are otherwise similar to the diaper and folds shown in FIG. 1. The fastener tabs shown on the diaper of the FIG. 1 embodiment and used to secure the diaper to the wearer are not shown in FIG. 9. It will be understood, however, that the diaper shown in FIG. 9 may also be provided with such fastener tabs, conveniently attached at the same positions as the fastener tabs on the diaper shown in FIG. 1.

The hose-like folds 20', 21' in FIG. 9 are identical with the folds 20, 21 shown in FIG. 1, and consequently corresponding structural elements have been identified by the same reference numeral but with the addition of an apostrophe. The hose-like folds 20', 21' of the FIG. 9 embodiment are disposed along respective end edges 6, 7 of the diaper. The folds 20', 21' are, in other respects, configured in precisely the same manner as the earlier described longitudinally extending folds 20, 21. When the diaper is fitted to a wearer, the end edges of the diaper are curved around the stomach and the backside of the wearer, wherewith the transverse folds 20', 21' will rise from their flattened, extended state, in the same way as the longitudinally extending folds 20, 21, to form a barrier against leakage along the end edges of the diaper. This diaper construction also provides a leakage barrier which seals resiliently against the body of the wearer in a vertical direction relative to the plane of the casing layer 1 and in the end parts 27', 28' of the fold, because the elastic elements 32', 33' are uniformly spaced laterally from the common base line 26' of the fold.

The invention shall not be considered to be restricted to the illustrated and described embodiments, since a number of variations are conceivable within the scope of the following Claims. For instance, as depicted in FIG. 11, the article may include a casing layer which is additional to casings layers 1 and 2, such as a second liquid-permeable casing layer 40 placed between the absorbent pad and that casing layer from which the fold is formed. Parts of this additional casing layer may also be included in the folds created, so as to provide a stronger fold having double inner and double outer sidewalls.

The variant in which two liquid-permeable casing layers are provided is particularly suitable when the folds in the longitudinal direction shall not extend over the whole of the article. In this case, the double casing layer is used solely in the crotch part, where it is most useful, and the end parts of the folds are fastened to the front and back part of the article in spaced relationship with the corresponding end edges. Instead of forming folds in the liquid-permeable casing layer, it is, of course, conceivable to instead form the folds in separate material layers which are placed on top of the casing layer of the article and which have no appreciable lateral extension beyond the fold lines, or at least do not extend right out to the side edges of the article. These separate material layers may either form one single discrete fold of limited extension also inwardly of the fold lines, or form two mutually spaced folds at respective side edges of the layer.

It will be also understood that inventive longitudinally and transversely extending folds can be combined, thus providing barriers around all edges of the article which fully circumvent a liquid and excrement receiving area inwardly of the folds.

It is also possible to place the common base line of the fold outwardly of the side edge or end edge of the absorbent pad, over the full length of the fold or over parts thereof.

We claim:

1. An absorbent article intended for one-time use only and comprising:

a liquid-permeable upper casing layer intended to face towards a wearer in use;

a lower casing layer intended to lie distal from the wearer in use;

an absorbent pad sandwiched between said liquid-permeable upper casing layer and said lower casing layer;

said article extending in a longitudinal direction and having one side edge and an opposite second side edge, said article further comprising a central receiving zone extending in said longitudinal direction and having a first edge and an opposite second edge spaced from said one and said second side edges, respectively, said first edge and said opposite second edge extending in said longitudinal direction;

a first tubular fold arranged between said first edge and said one side edge, and a second tubular fold arranged between said opposite second edge and said opposite second side edge, each tubular fold comprised of a flexible material which extends in the longitudinal direction on a side of the article which is intended to face the wearer in use, so as to form leakage barriers;

each fold having a first end part, a second end part, an intermediate part, and two first fold lines extending in the longitudinal direction, said first fold lines being close to one another so as to essentially coincide to form a common base line extending in the longitudinal direction;

each fold extending in a lateral direction away from the base line in opposite directions;

two elastic elements mounted within each tubular fold in a pre-stretched state and along said fold with one elastic element positioned on each side of the base line;

said first and second end parts having a maximum extension in said lateral direction and terminating at second fold lines on each side of said base line, said two elastic elements respectively extending along said second fold lines;

said end parts being joined to the liquid-permeable upper casing layer in a flat state, the folds being sufficiently spaced apart to enable body fluids to collect therebetween;

said two elastic elements being joined to the fold along said second fold lines only at the first and second end parts of the fold; and

all portions of the intermediate part of the fold and the two elastic elements extending therethrough being freely movable, whereby in an extended flat state of the article, each tubular fold including the intermediate part is flat, with each of the two elastic elements located on a respective side of the base line, and when in use, the article is forcibly curved to conform to a body of the wearer, and the intermediate part of each fold will lift vertically as a result of the action of the two elastic elements, so as to form said leakage barriers.

2. An article according to claim 1, wherein the base line of the folds are located inwardly of side edges of the absorbent pad, respectively.

3. An article according to claim 1, wherein each fold extends laterally equidistant from its base line in both directions, at least at one end part of the fold.

4. An article according to claim 1, wherein each fold extends laterally to different extents in respective direction from its base line, at least at one end part of the fold.

5. An article according to claim 1, further flexible material of each fold is the liquid-permeable upper casing layer.

6. An article according to claim 5, further including a separate causing layer beneath each fold and joined thereto on both sides of each fold's baseline to strengthen each fold.

7. An article according to claim 1, wherein the article is a diaper and includes additional elastic elements placed inside flaps which includes part of the upper and the lower casing layer and which extend laterally beyond side edges of the absorbent pad, and said additional elastic elements functioning as legs elastication when the diaper is in use.

8. An absorbent article intended for one-time use only and comprising:

a liquid-permeable upper casing layer intended to face towards a wearer in use;

a lower casing layer intended to lie distal from the wearer in use;

an absorbent pad sandwich between said liquid-permeable upper casing layer and said lower causing layer;

said article extending in a longitudinal direction and having two side edges, a first end edge and an opposite second end edge, a front part intended to lie forwardly of the wearer in use, a back part intended to lie rearwardly of the wearer in use, and a crotch part located between said front and said back parts said article further comprising a central receiving zone extending in said longitudinal direction and having a first edge and an opposite second edge spaced from said first and said opposite second end edges, respectively, said first edge and said second opposite second edge extending in a direction transverse to said longitudinal direction;

a first tubular fold arranged between said first edge and said first end edge, and a second tubular fold arranged between said opposite second edge and said opposite second end edge, each tubular fold comprised of a flexible material which extends in the transverse direction on a side of the article which is intended to face the wearer in use, so as to form leakage barriers;

each fold having a first end part, a second end part, an intermediate part, and two first fold lines extending in the transverse direction, said first fold lines being close to one another so as to essentially coincide to form a common base line extending in the tranverse direction;

each fold extending in said longitudinal direction away from the base line in opposite directions;

two elastic elements mounted within each tubular fold in a pre-stretched state and along said fold with one elastic element positioned on each side of the base line;

said first and second end parts having a maximum extension in the longitudinal direction and terminating at second fold lines on each side of said base line, said two elastic elements, respectively, extending along said second fold lines;

said end parts being joined to the liquid-permeable upper casing layer in a flat state, the folds being sufficiently spaced apart to enable body fluids to collect therebetween;

said two elastic elements being joined to the fold along said second fold lines only at the first and second end parts of the fold; and

all portions of the intermediate part of the fold and the two elastic elements extending therethrough being freely movable, whereby in an extended flat state of the article, each tubular fold including the intermediate part is flat, with each of the two elastic elements located on a respective side of the base line, and when in use, the article is forcibly curved to conform to a body of the wearer, and the intermediate part of each fold will lift vertically as a result of the action of the two elastic elements, so as to form said leakage barriers.

9. An article according to claim 8, wherein said first and second folds are located close to said first and second end edges, respectively, of the article.

10. An article according to claim 8, wherein each fold extends longitudinally to different extents in respective directions from its base line, at least at one end part of the fold.

11. An article according to claim 8, wherein each fold extends longitudinally equidistant from its base line in both directions, at least at one end part of the fold.

12. An article according to claim 8, wherein the flexible material of each fold is the liquid-permeable upper casing layer.

13. An article according to claim 8, further including a separate casing layer beneath each fold and joined thereto on both sides of each fold's base line to strengthen each fold.

* * * * *

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Widlund et al.

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(45) **Date of Patent: *Oct. 8, 2002**

(54) **METHOD FOR MANUFACTURING A PANTS-TYPE DIAPER OR SANITARY PANTY, AND SUCH AN ARTICLE**

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(73) Assignee: **SCA Hygiene Products AB**, Goteborg (SE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(22) Filed: **Dec. 21, 2000**

Related U.S. Application Data

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**[7] **A61F 13/15**; A61F 13/20; A44B 19/00; B29C 53/00

(52) **U.S. Cl.** **604/390**; 604/385.03; 604/391; 604/394; 156/66; 156/204; 156/217; 156/272

(58) **Field of Search** 604/365, 366, 604/373, 386, 389-394, 396, 399, 385.24-385.3; 156/66, 217, 91, 204, 277; 2/235

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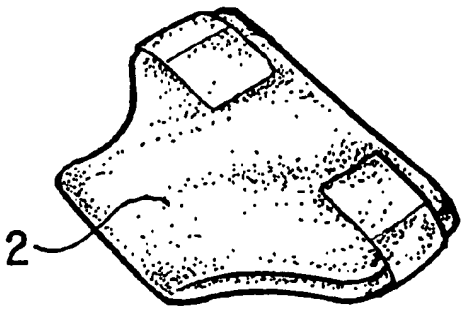
Assistant Examiner—K. M. Reichle
(74) *Attorney, Agent, or Firm*—Burns Doane Swecker & Mathis L.L.P.

(57) **ABSTRACT**

A method of manufacturing an absorbent article in the form of a pants diaper or a sanitary panty starts from a flat blank which includes an elongated absorbent body enclosed between two casing sheets which at opposing front and rear end parts of the absorbent body have side parts which extend laterally beyond the body on the opposite sides thereof. The method includes the step of folding the blank about a transverse axis so that the end edges of the side parts lie edge-to-edge. The front and rear side parts of the blank which oppose one another in the folded state of the blank are joined together by a releasable and refastenable fastener. A pants diaper can be manufactured in accordance with this method.

14 Claims, 6 Drawing Sheets



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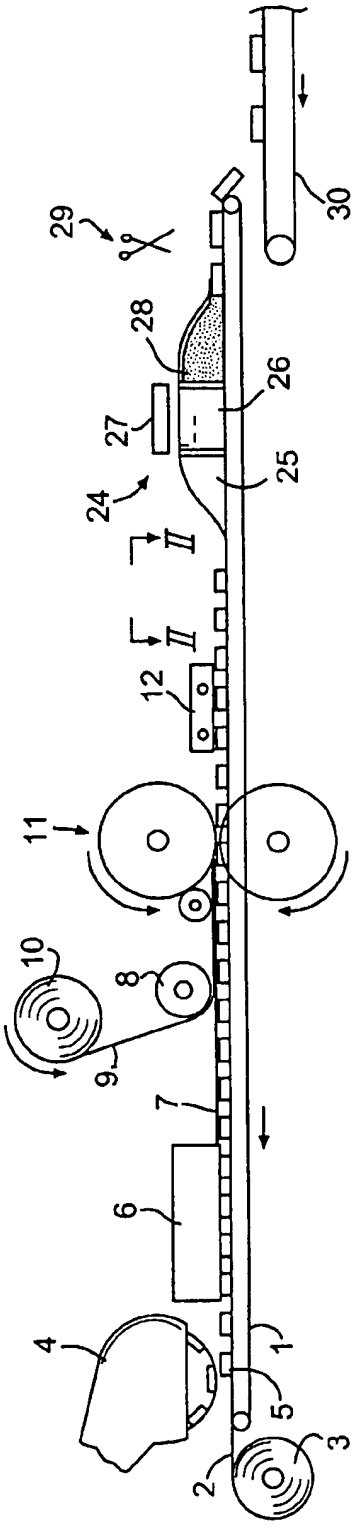

FIG. 1

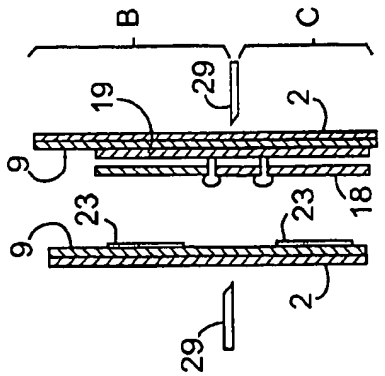

FIG. 4

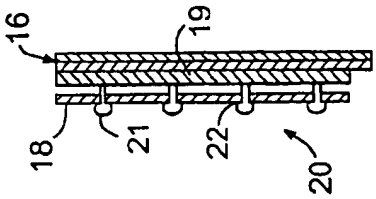

FIG. 3A

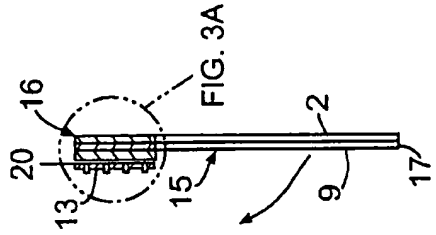

FIG. 3

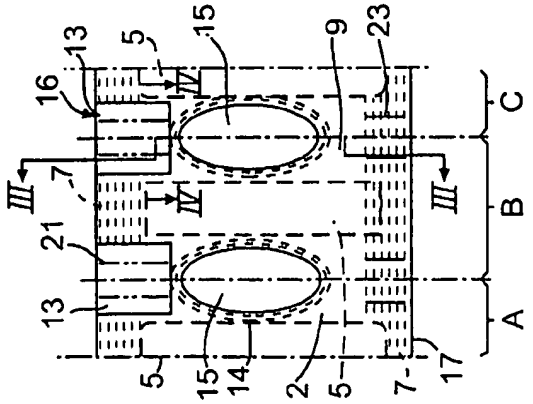

FIG. 2

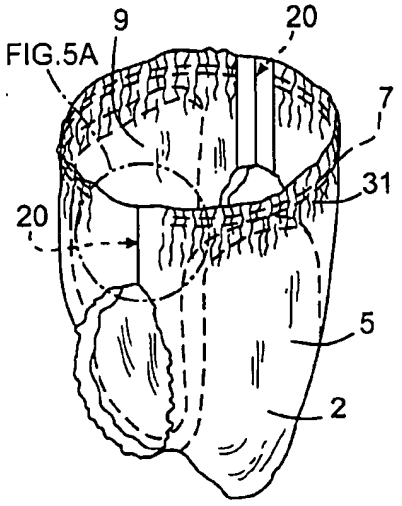

FIG. 5

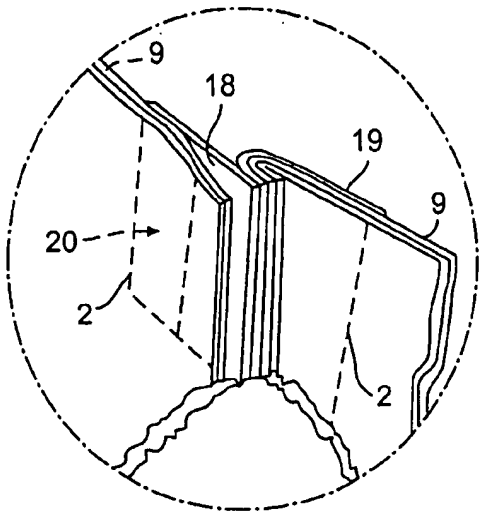

FIG. 5A

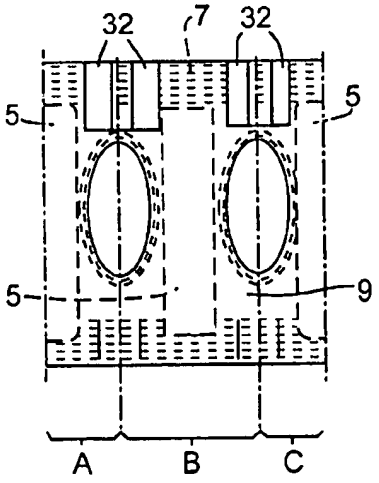

FIG. 6

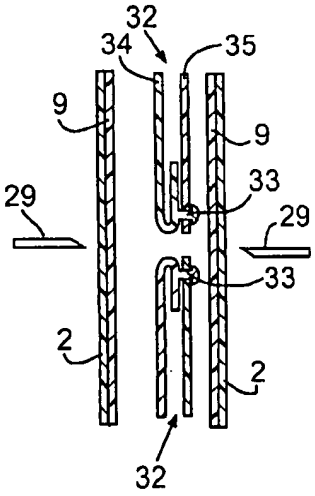

FIG. 7

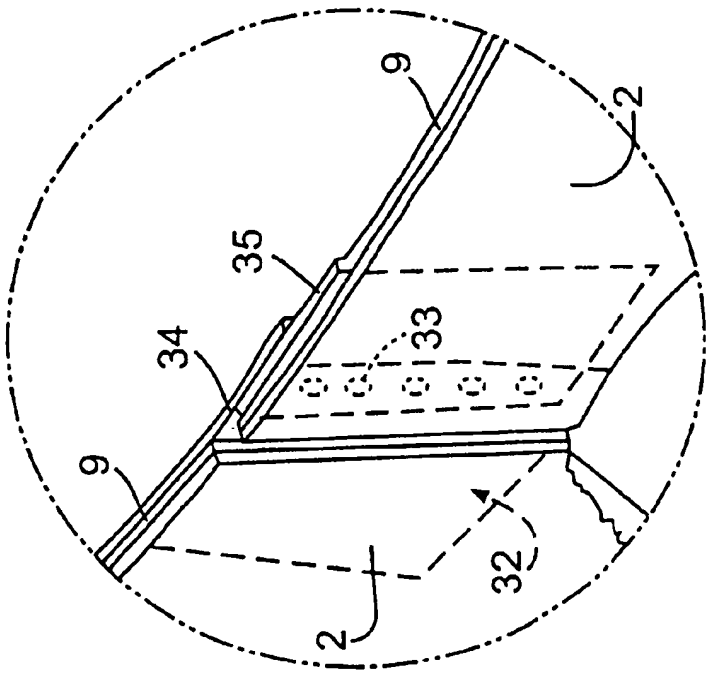

FIG. 8A

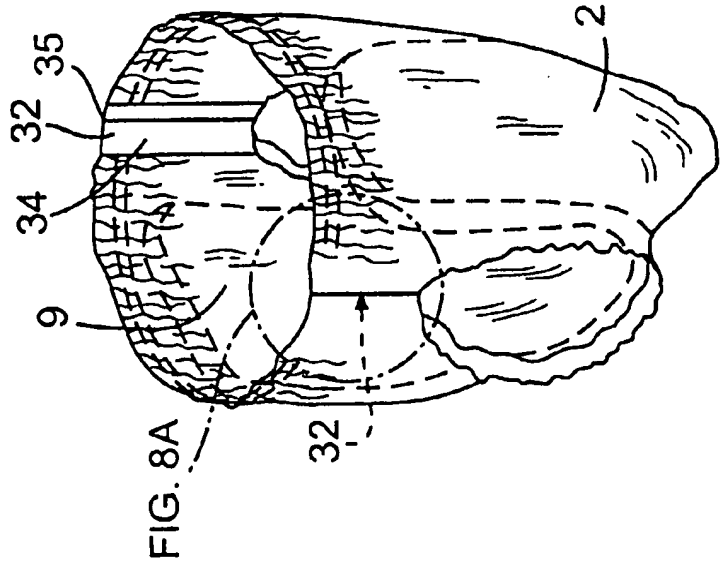

FIG. 8

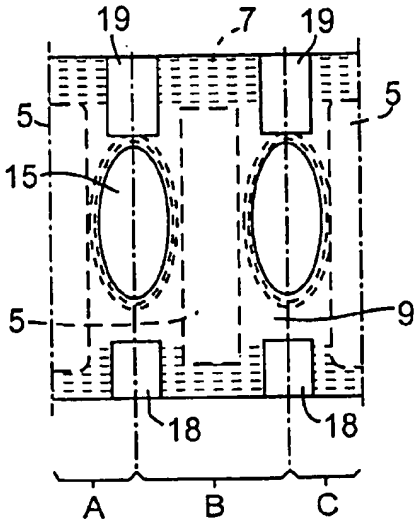

FIG. 9

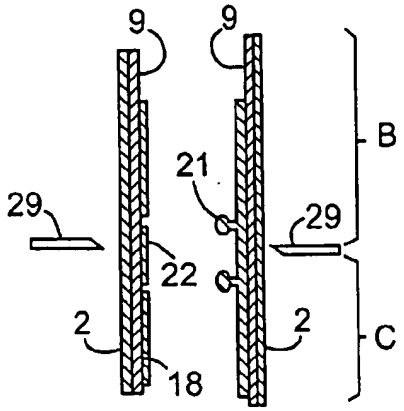

FIG. 10

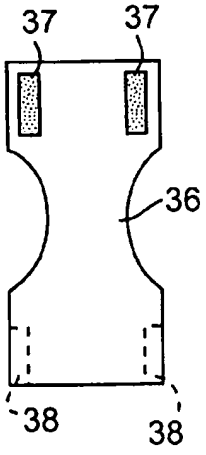

FIG. 11

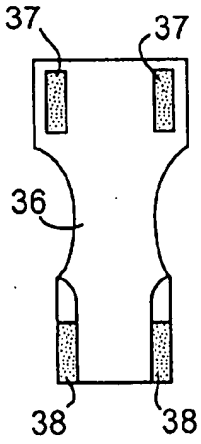

FIG. 12

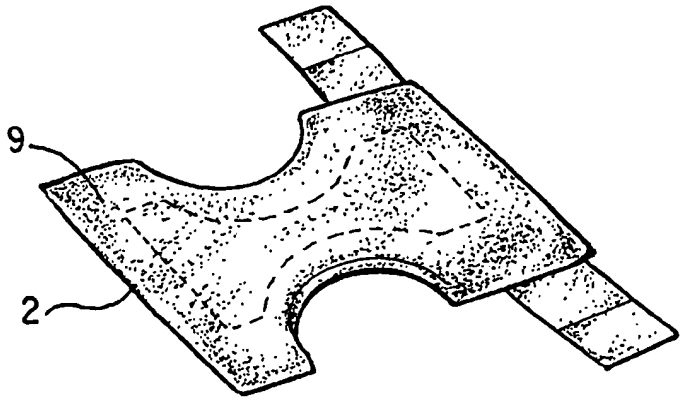

FIG. 13A

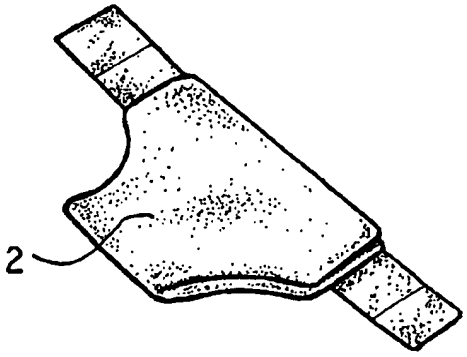

FIG. 13B

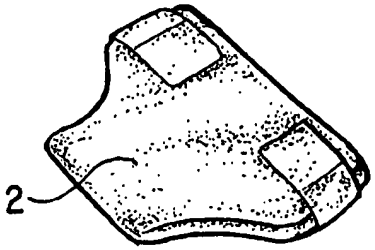

FIG. 13C

METHOD FOR MANUFACTURING A PANTS-TYPE DIAPER OR SANITARY PANTY, AND SUCH AN ARTICLE

This application is a continuation of U.S. application Ser. No. 08/718,297, which was a national stage filing under 35 U.S.C. 371 of PCT Application No. PCT/SE95/00391 filed Apr. 11, 1995, which International Application was published by the International Bureau in English on Oct. 19, 1995.

BACKGROUND OF THE INVENTION

The present invention relates to a method of manufacturing an absorbent article in the form of a pants-type diaper or a sanitary panty, beginning with a flat diaper blank which comprises an elongated absorbent body enclosed between two casing sheets which at opposing front and rear end parts of the absorbent body have side parts which extend laterally beyond the abosorbent body on both sides thereof, said method comprising the step of folding the blank about a transverse axis so that the end edges of said side parts will lie edge-to-edge. The invention also relates to articles manufactured in accordance with the method.

So-called all-in-one diapers are being replaced to an ever greater extent with pants-type diapers, or so-called training pants, for slightly older diaper-wearing children. Pants-type diapers have a number of good features. They fit well on the wearer, they are easy to put on and take off with the child in a standing position, they sit firmly in place after having been put onto a child, and conform to the anatomy of the child as the child moves, in a comfortable fashion. Moreover, pants-type diapers resemble conventional underpants and it is easy to understand how they shall be used, thereby in many instances enabling somewhat older diaper-wearing children to perform themselves the simple operations required in putting on the pant diaper. However, pants-type diapers, or training pants, also have certain drawbacks. They are difficult to change while the child is lying on his/her back and, when changing the pant diaper, require any garment that is worn on top of the pant diaper to be removed completely. Neither can a used pants-type diaper be rolled-up and sealed in the same manner as an all-in-one diaper. In addition, a dirty pant diaper which contains feces is liable to soil the wearer when removing the pant diaper.

OBJECTS AND SUMMARY

An object of the present invention is to provide an absorbent article in the form of a pants-type diaper or a sanitary panty which is not encumbered with the aforesaid drawbacks, while beginning with a pants-type diaper blank or a sanitary panty blank that has been manufactured in the same way as conventional diapers.

In accordance with the invention, this object is achieved with a method of the kind defined in the introduction which is characterized in that the side edges of the front and the rear side parts which mutually oppose one another in the folded state of the blank are joined together with the aid of a releasable and refastenable fastener means.

The present invention is directed to a method of manufacturing an absorbent article in the form of a pants diaper or a sanitary panty. The method comprises the steps of providing a web of a plurality of mutually joined flat blanks, each of said plurality of blanks including an elongated absorbent body enclosed between two casing sheets which at mutually opposing front and rear end parts of the absorbent body have side parts that extend laterally beyond said body on both sides thereof, the side parts having end edges; separating the mutually joined blanks from each other by cutting individual blanks from the web of mutually joined blanks; providing a releasable and refastenable fastener having two elements, the two elements of the releasable and refastenable fastener being joined to each other; mounting one of the two elements which include mutually complementary members of the releasable and refastenable fastener on the outside of the side parts of one of the front and rear end parts of each of said individual blanks; folding each of the individual blanks so that the end edges of said side parts of each said blank lie edge-to-edge; mounting a second of the two elements on the outside of the side parts of the opposing other of the front and rear end parts so as to releasably and refastenably connect the opposing side parts thereby forming a pants diaper or a sanitary panty having a completed circumferential waist and defined leg openings; and thereafter conveying the pants diaper or sanitary pants to a packaging station.

The present invention is also directed to an absorbent article in the form of a pants diaper or sanitary panty having a complete circumferential waist and defined leg openings directly after manufacture. The article comprises an elongated absorbent body enclosed between two casing sheets, wherein at opposing front and rear end parts of the abosorbent body said casing sheets having side parts which extend laterally beyond said absorbent body on both sides thereof, and the opposing front and rear side parts being joined together with releasable and refastenable fasteners, respectively, each of said releasable and refastenable fasteners being comprised of mutually complementary members of two elements, of which one of the two elements is fastened to the outside of the front side part and a second of the two elements is fastened to the outside of the rear side part, a circumferential waist opening including waist elastics, and a pair of defined leg openings including elastics.

According to one preferred embodiment of the invention, one of two elements which include mutually complementary members of a releasable and refastenable fastener means, is attached to one of said front and rear side parts which mutually oppose one another in the folded state of the blank, while the other of said two elements is attached to the other of said side parts. In the case of this embodiment, the two elements are joined together and, prior to folding the blank, one of the elements is attached to one of the front and rear side parts that oppose each other when the blank is folded, while other element is attached to the other side part in conjunction with folding the blank.

According to one variant of this embodiment of the inventive method, prior to folding the blank the two elements are attached in a mutually joined state to one of the front and rear side parts that oppose each other in the folded state of the blank, while the other element is attached to the other side part subsequent to folding the blank.

According to a second embodiment of the method, prior to folding the blank, the two elements are attached to respective side parts while spaced apart, whereafter the two elements are joined to one another in the final stage of folding the blank.

According to a third embodiment of the method, the two elements are attached in a mutually joined state after folding the blank. More particularly, this embodiment of the invention is directed a method of manufacturing an absorbent article in the form of a pants diaper or a sanitary panty, the method comprising the steps of providing a web of a

plurality of mutually joined flat blanks, each of the plurality of blanks including an elongated absorbent body enclosed between two casing sheets which at mutually oppsoing front and rear end parts of the absorbent body have side parts that extend laterally beyond the body on both sides thereof, the side parts having end edges. The method includes separating the mutually joined blanks from each other by cutting individual blanks from the web of mutually joined blanks; folding each of the individual blanks so that the end edges of said side parts of each said blank lie edge-to-edge; and providing a releasable and refastenable fastener having two elements, the two elements of the releasable and refastenable fastener being joined to each other. Further, the method includes mounting one of the two elements which include mutually complementary members of the releasable and refastenable fastener on the outside of the side parts of one of the front and rear end parts of each of said folded individual blanks; mounting a second of the two elements on the outside of the side parts of the opposing other of the front and rear end parts of said folded blank so as to releasably and refastenably connect the opposing side parts thereby forming a pants diaper or a sanitary panty having a completed circumferential waist and defined leg openings; and thereafter conveying the pants diaper or sanitary pants to a packaging station.

The invention also relates to an absorbent article in the form of a pants-like diaper or sanitary panty, said article comprising an elongated absorbent body which is enclosed between two casing sheets which extend laterally outside the absorbent body on both sides thereof at the mutually opposing front and rear end parts of said body. The article is characterized in that the side edges of mutually opposing front and rear side parts are joined together by a releasable and refastenable fastener means.

According to one preferred embodiment of the article, the releasable and refastenable fastener means is comprised of mutually complementary members of two fastener elements, of which one is attached to the front side part and the other to the rear side part. The mutually complementary members may have the form of buttons and button holes, hooks and eyes, beads and grooves, or the male and female parts of self-fastening bands, e.g. VELCRO tapes.

According to one variant, the fastener means has the form of an adhesive coating.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail with reference to the accompanying drawings, in which

FIG. **1** illustrates schematically plant machinery for manufacturing an inventive pants-type diaper by means of an inventive method;

FIG. **2** illustrates from above part of the material web shown in FIG. **1**, in the manufacturing stage immediately prior to folding and joining the pants-type diaper blanks to form pants-type diapers;

FIG. **3** is a sectional view taken on the line III—III in FIG. **2**;

FIG. **3A** is an enlarged view of part of the section shown in FIG. **3**;

FIG. **4** is a cross-sectional view taken on the line IV—IV in FIG. **2** and illustrates schematically a final stage in the manufacture of the pants-type diaper;

FIG. **5** is a perspective view of a pants-tupe diaper produced by means of the inventive method;

FIG. **5A** is an enlarged part of the section shown in FIG. **5**;

FIGS. **6–8** are views similar to the view of FIGS. **2, 4** and **5**, respectively, and show the manufacture of a second embodiment of an inventive pants-type diaper;

FIG. **8A** is an enlarged part of the section shown in FIG. **8**;

FIGS. **9** and **10** are views similar to the views of FIGS. **2** and **4**, respectively, and illustrate a third embodiment of the manufacture of an inventive pants-type diaper; and

FIGS. **11** and **12** illustrate a fourth embodiment of the manufacture of an inventive pants-type diaper.

FIGS. **13A–13C** illustrate additional manufacturing steps for the individual blanks.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates schematically plant machinery for manufacturing pants-type diapers, including a conveyor path **1** by means of which casing material **2** taken from a storage reel **3** is conveyed from left to right in FIG. 1. Located downstream of the reel **3** is a device **4** which lays absorbent bodies **5** at regular intervals on the underlying web of casing material **2**. Located downstream of the device **4** is a device **6** which lays elastic elements in a specific pattern onto or immediately above the web of casing material **2**. These elastic elements, of which one **7** is shown schematically in FIG. **1** and which are preferably comprised of elastic threads or ribbons, form the waist and leg elastic of the manufactured pants-type diaper. Located downstream of the device **6** are guide rollers **8** which function to guide a second web of casing material **9** from roll **10** onto the first web **2**, While downstream of the guide rollers **8**, there is located a device **11** which brings the webs of casing material together and fastens the webs to one another at those parts thereof which lie outside the absorbent bodies **5**. The plant machinery hitherto described functions in the same way as the plant machinery used to manufacture conventional all-in-one diapers and the composite product leaving the device **11** will be comprised of a continuous string of pants-type diaper blanks which, similar to the all-in-one diapers produced in conventional plants, includes an absorbent body which is enclosed between the two casing sheets and also elastic elements. At this stage of manufacture, the pants-type diaper blank differs from a typical diaper blank mainly in that the waist elastic has a different form to the waist elastic with which a diaper blank may be provided, as will be made more apparent in the following. The devices **4, 6, 8** and **11** are preferably known devices suitable for producing a pants-type diaper blank of the aforesaid kind. Since a detailed description of the construction of these devices is not needed to acquire an understanding of the invention, the devices will not be further described.

Located downstream of the device **11** is a device **12** which functions to attach fastener elements **13** to the underlying moving web of mutually connected blanks. The device **12** will preferably include plungers or the like that are operative in pressing glue-coated fastener elements **13** against the casing sheet **9**. FIG. **2** illustrates from above a section of the web of mutually joined blanks subsequent to the web exiting from the device **12**. The section illustrated in the Figure includes a complete pants-type diaper blank B and parts of two mutually adjacent blanks A and C. As will be seen from the Figure, the device **6** lays-out across the blank a plurality of elastic threads **7** which extend sequentially in the transverse direction of the blank and which form the waist elastic of a manufactured pants-type diaper, and also lays-out around openings **15** cut from the web elastic threads **14**

which form the leg elastic of a manufactured pants-type diaper. The openings are preferably cut from the web when joining the casing sheets together with the aid of some appropriate means, for instance by means of a punch included in the device **11** or located immediately downstream thereof.

The pants-type diaper blanks A, B, C include a front edge **16**, a rear edge **17** and a central part which is delimited by the mutually opposing long edges of the abosorbent body **5** and the extensions of said long edges, front side parts on both sides of the central part and the rear side parts, these side parts being delimitied by the front edge **16** and the rear edge **17** respectively, the openings **15** lying on respective sides of the central part, and the imaginary separation lines between the individual blanks, A, B and C, as illustrated in FIG. **2** in dash-dotted lines.

The fastener elements **13**, as best shown in FIG. **5**A, are comprised on two similarly shaped rectangular pieces **18**, **19** of flexible materials which are joined together by two releasable and refastenable fastener means **20**. As will best be seen from FIGS. **3**A and **4**, each of the fastener means **20** is comprised of a row of projections **21** which extend from the fastener piece **19** and pass through a row of through-penetrating openings **22** formed in the fastener piece **18** and complementary in shape to a respective projection **21**. The fastener elements **13** are placed in the front side parts of the blanks, symmetrically in relation to the imaginary blank separation lines, so that the two fastener means will lie on opposite sides of said lines.

Pants-type diapers are produced from the blanks shown in FIGS. **2** and **3**, simply by folding the blanks in the direction indicated by the arrow in FIG. **3**, so that the edges **16** and **17** will lie opposite one another, and by fastening the casing sheet **9** to the fastener elements **13** in conjunction therewith. Glue beads **23** are suitably applied to the pieces **18** of the fastener elements **13** in conjunction with bringing the edges **16**, **17** together. Naturally, the glue beads **23** may instead be applied to the casing sheet **9** on the rear side parts prior to folding the blanks, as indicated in FIGS. **2** and **4**.

The plant illustrated in FIG. **1** includes downstream of the device **11** a device **24** by means of which the web of blanks is folded together and the front and rear side parts of the blanks are joined to one another. The device **24** may include fixed guide means **25** having mutually converging side walls, plunger means **26** which intermittently press the rear side parts of the blanks against the front side parts thereof, applicator means **27** for applying glue to the fastener elements **13** or to the rear side parts, and fixed guide means **28** having side walls which extend successivley from a vertical to a horizontal position.

The web moving through the guide means **28** is thus comprised of a string of mutually joined pants-type diapers which after exiting from the guide means **28** are separated from one another by means of an appropriate cutting tool **29** and conveyed by suitable conveying means **30** to a packaging station in which they are packaged as individual pants-type diapers.

FIG. **4** illustrates part of the web in the final stage of the folding operation, this Figure also showing the cutting tool **29** schematically in order to indicate that the individual diapers can be cut from the web in conjunction with fastening the rear side parts of the blank to the piece **18** of the fastener element **13**, as will be understood.

It will also be understood that the fastener arrangement can be attached to the web in ways other than by gluing, for instance by heat-welding or ultrasonic welding.

FIG. **5** is a perspective view of a pants-type diaper manufactured by the aforedescribed method. A pants-type diaper is intended to be put on in the same way as a pair of underpants, and is characterized by an elastic waist part which can be stretched so as to enable the pant diaper to be easily drawn over the wearer's hips when putting on and removing the pant diaper, and which is so elastic as to ensure that when worn the pant diaper will be held securely in place by the contraction forces exerted by the elastication in the waist part of the pant diaper. In order to fulfil these functional requirements while, at the same time, limiting the number of product sizes required, the pant diaper will preferably have a stretch which is greater than 80%, i.e. it shall be possible to stretch the waist part to an extent which corresponds to 1.8 times the circumference of the waist part of a pants-type diaper in a relaxed state. When the pant diaper is worn, the combined contraction force in the waist part, i.e. the sum of the forces exerted by the elastic provided in the front part, the rear part and the side parts of the pant diaper, will preferably exceed 3 N.

The pants-type diaper illustrated in FIG. **5** is suitably constructed in the same way as the pants-type diaper described in Swedish Patent Application No. 9200663-4; and includes an absorbent body **5** enclosed between an inner and an outer casing sheet, **9** and **2**, respectively. The inner casing sheet **9** is liquid-permeable and is comprised, for instance, of nonwoven material compiled from fibres of polyethylene, polyproplylene, polyester or mixtures thereof. Viscose fibres may also be used. It is also conceivable to form the inner casing sheet from a perforated plastic sheet, for instance a preforated polyethylene sheet. The outer casing sheet **2** is liquid-impermeable or at least hydrophobic and may, for instance, comprise a sheet of polyethylene or nonwoven material which has been coated with or laminated with polyolefins, so as to be made liquid-impermeable or at least hydrophobic. For aesthetic and psychological reasons, the outer casing sheet **2** may be comprised of two layers, an inner liquid-impermeable layer and a layer of fabric-like material disposed outside the inner layer. The wearer will then see and feel the diaper as a fabric garment rather than as a plastic garment. When the outer casing sheet has this latter construction, it is not necessary for the liquid-impermeable sheet to have the same extension as the fabric-like sheet, but may be smaller than said sheet, for instance liquid-impermeable casing material can be omitted from the side parts of the diaper.

The absorbent body **5** may contain cellulose fluff pulp with or without an admixture of particles of so-called superabsorbent material or thermoplastic melt fibres, and may be comprised of one or more layers.

The waist part **31** of the pants-type diaper includes a plurality of sequentially mounted elastic threads **7**, as best shown in FIG. **2**, each of which extends transversely around the circumference of the centre part. In this way, there is formed a relatively broad elastic waist part. As will be understood, elastic ribbons, bands or the like may be used instead of elastic threads, or other elastically stretchable material can be used, such as elastically stretchable plastic film, an elastically stretchable nonwoven material, or like material.

Similar to a pair of underpants, the pants-type diaper illustrated in FIG. **5** has a waist opening and two leg openings, which are provided with leg elastic in a conventional manner. The pant diaper is put on by inserting the legs of the wearer through the leg openings and then drawing the pant diaper up over the wearer's hips. The contraction forces exerted by the elastic elements at the waist opening, i.e. at

the uppermost part of the waist part **31**, are preferably greater than the contraction forces exerted in the remainder of the waist part. This will ensure that the pant diaper remains seated in its intended position, even when the absorbent body has absorbed urine to a point of saturation.

According to the invention, the front and the rear side parts of the pant diaper are joined together by means of a releasable and refastenable fastener means **20**. When the fastener means **20** is released, the pant diaper can be removed and changed without needing to remove completely any trousers or like garment worn outside the pant diaper, since the rear part or the front part of the pant diaper can then be withdrawn between the wearer's legs. A replacement pants-type diaper can then be placed on the wearer, by releasing the fastener means **20** and inserting the front part or the rear part of the replacement pant diaper between the wearer's legs. The side parts are then fastened together, by refastening the fastener means **20**, whereafter the pant diaper is drawn up to its correct position in the same way as a pair of underpants, unless this has already been done in conjunction with refastening the fastener means.

FIGS. **6–8** are views which correspond to the respective views of FIGS. **3, 4** and **5**, and illustrate a second embodiment of the invention. The second embodiment of the inventive pants-type diaper is manufactured in the same way as the earlier described, up to the point of attaching the fastener elements to the casing sheet **9**. Those elements in FIGS. **6–8** which find correspondence in FIGS. **1–5** have been identified with the same reference signs. The embodiment illustrated in FIGS. **6–8** differs from the earlier described embodiment in that instead of one fastener element **13** which includes two fastener means **20**, there are attached two fastener elements **32** each of which includes one fastener means **33** on either side of each imaginary blank separating line between the mutually adjacent pants-type diaper blanks A–C of a mutually joined string of blanks. In other respects, a pants-type diaper according to this second embodiment is manufactured in the same way as that described with reference to FIGS. **1–5**. The fastener elements **32** of this embodiment, as best shown in FIG. **8**A, also include two flexible pieces **34, 35** which are mutually joined by fastener means **33** similar to the fastener means **20** of the first embodiment. The end part of the flexible piece **34** that contains the row of projections is folded-in against the remainder of said piece. The fold or pleat obtained when folding-in said end part will be unfolded or lifted when wearing a pants-type diaper according to this second embodiment of the invention, as illustrated in FIG. **8**, which is a perspective view of one such diaper.

FIGS. **9** and **10** illustrate a third exemplifying embodiment of a method of manufacturing an inventive pants-type diaper. The views shown in FIGS. **9** and **10** correspond to the views shown in FIGS. **2, 4** and **6, 7**, respectively. The diaper according to this third embodiment of the invention is manufactured in the same way as that earlier described, up to the point of applying the fastener elements to the casing sheet **9**. Those elements in FIGS. **9, 10** which find correspondence in FIGS. **1–5** have been identified by the same reference signs. The third embodiment differs from the first embodiment in that the fastener elements **13** are applied by the device **12** with the pieces of material **18, 19** separate from one another, i.e. with the fastener means **20** loosened. In this regard, the pieces **18** are applied to the front side parts, whereas the pieces **19** are applied to the rear side parts. When subsequently folding the web, the projections **21** of each fastener means **20** are pressed into the openings **22**, whereafter manufactured pants-type diapers having the configuration shown in FIG. **5** are produced by cutting with the aid of the tool **29**.

All of the aforedescribed, illustrated fastener means are configured so that an opened pants-type diaper can only be refastened when the separate parts of the side parts are placed in the same positions as those occupied prior to opening the pant diaper. This ensures that the good fit afforded by a pants-type diaper will be retained after the pant diaper has been refastened. In this way, the absorbent body of a refastened pant diaper will also lie in its intended position in relation to the anatomy of the wearer, which is important in ensuring that no leakage will occur. Furthermore, the absorbent bodies of present-day diapers and sanitary napkins are to an ever increasing extent configured to receive body fluid within particularly defined areas of the absorbent body, and the function of such bodies can be jeopardized when the fluid is received outside these areas. The waist elastic of pants-type diapers and sanitary panties are also dimensioned with a starting point from a specific circumferential length in the natural state of the product, i.e. when no load is exerted thereon, and consequently it is important to the intended function of the waist elastic that its circumferential length is retained after refastening an opened pants-type diaper or sanitary panty. It will be understood, however, that the fastener means need not have the illustrated configuration and that other types of fastener means can be used within the scope of the invention, such as self-fastening or hook and loop means, e.g. VELCRO tape, or adhesive applications that have a relatively large extension in the circumferential direction of the pant diaper and also in its height direciton, i.e. a direction at right angles to its circumference. However, it is convenient in such casings to mark or indicate on the casing sheets how the separate parts of these side parts shall be fastened together. Preferably, it will be apparent how the parts shall be related to one another in a vertical or height direction, since it is particularly important with respect to the fit of the pant diaper that any deviations in the vertical position of the separate parts of said side parts are small. When using self-fastening tape or adhesive fastener means, it will preferably be ensured that these fastener means are so disposed as to be subjected solely to shear forces when the pant diaper is worn. The second embodiment of the fastener means described hitherto is preferred for this reason.

The aforedescribed method of fastening the tapes to the side parts of a pants-type diaper blank can be applied when the absorbent bodies are placed transversely to or when placed longitudinally to the direction of web movement in the manufacture of pants-type diapers, but with the difference that in the longitudinal production of pant diapers, it is necessary to cut the individual blanks from the string of blanks prior to folding the rear side parts onto the front side parts.

When the blanks are advanced as individual blanks, fastener elements of the aforedescribed kind having closed fastener means can be applied to the casing sheet **2** instead of the casing sheet **9**, by first fastening a free end of the fastener elements to one of the front side parts of the blank, as shown in FIG. **13**A, and thereafter folding the blank, as shown in FIG. **13**B. The fastener elements are then folded-in over the rear side parts of the folded blank and fastened thereto, as shown in FIG. **13**C. As will be understood, the flat or non-folded fastener elements can also be attached to the inner casing sheet **9**, on the front side parts of the individual flat blank and thereafter folding the blank and then the fastener elements, whereupon the fastener elements fasten to the inner surfaces of the front side parts and to the outer

surfaces of the rear side parts. The fastener elements can also be applied after having folded the individual blanks, for instance by passing the edges of the blank side parts folded against one another between the free edges of a folded fastener element and then pressing the edges of the fastener element firmly against the side parts with the aid of an externally applied force.

It will be noted in this regard that the fastener elements may, of course, be fastened to the front and the rear side parts in a reverse order to that described, i.e. are first attached to the rear side parts and then to the front side parts.

According to a variant of the method described with reference to FIGS. **6–8**, the folded fastener elements **32** can be passed in between the front and rear side parts during the final stage of folding the blanks, and fastened to the blanks in a single stage.

Alternatively, the side parts of the individual pants-type diaper blanks may be folded prior to folding the blank or in conjunction therewith, instead of folding the fastener elements. An example of this is illustrated in FIGS. **11** and **12**. These Figures illustrate schematically a pants-type diaper blank **36** in which one part **37** of a fastener element is comprised of two mutually coacting parts **37, 38** which are fastened respectively to the inner surface of the blank at the front side parts thereof, while the other part **38** of the fastener elements is fastened to the outer surface of the blank at the rear side parts thereof. FIG. **11** shown the blank **36** from above, subsequent to having cut the blank from a web of mutually joined blanks. The parts **38** of the fastener elements are preferably attached to the outer casing sheet in an initial stage of manufacture, prior to mounting absorbent bodies, elastic elements and an inner casing sheet. In order to produce a finished pants-type diaper from a blank that has the configuration illustrated in FIG. **11**, those parts of the rear side parts of the blank **36** that contain the parts **38** of the fastener elements are folded against the inner surface of the blank, so as to provide a blank **36** having the configuration shown in FIG. **12**. The blank is then folded so that the front and the rear side parts thereof are placed edge-to-edge, and the coacting parts **37, 38** are pressed firmly against one another. The parts **38** include fastener elements of the earlier described kind, and self-fastening or hook and loop tapes and adhesive tapes may also be used, since the resultant connection or join will be subjected essentially to shear forces when the diaper is worn. It will be understood that the parts **38** may be applied after folding-in the rear side parts of the blank, instead of in an initial stage of manufacture.

Although the described and illustrated exemplifying embodiments of the invention are directed solely to pants-type diapers, it will be understood that the invention can also be applied to sanitary panties, i.e. panties in absorbent bodies for absorbing menstrual fluids or light incontinence discharges are integrated.

It will also be understood that the described and illustrated exemplifying embodiments can be modified within the scope of the invention. For instance, the absorbent body may have a form different to that described and may include several layers, which in turn means that the described plant for manufacturing pants-type diapers in accordance with the invention will be modified correspondingly,

Furthermore, the pants-type diaper blanks can be folded and the front and rear side parts of the blanks brought together with the aid of means other than those described. The individual pants-type diapers can be cut from the continuous web of blanks in conjunction with bringing the front and the rear side parts of the blanks together, instead of in a separate following stage. The invention is therefore restricted solely by the scope of the following Claims.

What is claimed is:

1. A method of manufacturing an absorbent article in the form of a pants diaper or a sanitary panty, said method comprising the steps of:

providing a web of a plurality of mutually joined flat blanks, each of said plurality of blanks including an elongated absorbent body enclosed between two casing sheets which at mutually opposing front and rear end parts of the absorbent body have side parts that extend laterally beyond said body on both sides thereof, the side parts having end edges;

separating the mutually joined blanks from each other by cutting individual blanks from the web of mutually joined blanks;

providing a releasable and refastenable fastener having two elements, the two elements of the releasable and refastenable fastener being joined to each other;

mounting one of the two elements which include mutually complementary members of the releasable and refastenable fastener on the outside of the side parts of one of the front and rear end parts of each of said individual blanks;

folding each of the individual blanks so that the end edges of said parts of each said blank lie edge-to-edge;

mounting a second of the two elements on the outside of the side parts of the opposing other of the front and rear end parts so as to releasably and refastenably connect the opposing side parts thereby forming a pants diaper or a sanitary panty having a completed circumferential waist and defined leg openings; and thereafter

conveying the pants diaper or sanitary pants to a packaging station.

2. A method of manufacturing an absorbent article in the form of a pants diaper or a sanitary panty, said method comprising the steps of:

providing a web of a plurality of mutually joined flat blanks, each of said plurality of blanks including an elongated absorbent body enclosed between two casing sheets which at mutually opposing front and rear end parts of the absorbent body have side parts that extend laterally beyond said body on both sides thereof, the side parts having end edges;

separating the mutually joined blanks from each other by cutting individual blanks from the web of mutually joined blanks;

folding each of the individual blanks so that the end edges of said side parts of each said blank lie edge-to-edge;

providing a releasable and refastenable fastener having two elements, the two elements of the releasable and refastenable fastener being joined to each other;

mounting one of the two elements which include mutually complementary members of the releasable and refastenable fastener on the outside of the side parts of one of the front and rear end parts of each of said folded individual blanks;

simultaneously while mounting said one of the two elements, mounting a second of the two elements on the outside of the side parts of the opposing other of the front and rear end parts of said folded blank so as to releasably and refastenably connect to the opposing side parts thereby forming a pants diaper or a sanitary panty having a completed circumferential waist and defined leg openings; and thereafter

conveying the pants diaper or sanitary pants to a packaging station.

3. An absorbent article in the form of a pants diaper or sanitary panty having a complete circumferential waist and defined leg openings directly after manufacture, said article comprising;

an elongated absorbent body enclosed between two casing sheets, wherein at opposing front and rear end parts of the absorbent body said casing sheets having side parts which extend laterally beyond said absorbent body on both sides thereof, and the opposing front and rear side parts being joined together with releasable and refastenable fasteners, respectively, each of said releasable and refastenable fasteners being comprised of mutually complementary members of two elements, of which one of the two elements is fastened to the outside of the front side part and a second of the two elements is fastened to the outside of the rear side part,

a circumferential waist opening including waist elastics, and

a pair of defined leg openings including elastics.

4. An article according to claim 3, wherein the side parts of the front and rear end parts have the same lateral extenstion.

5. An article according to claim 4, wherein the mutually complementary members are comprised of hooks and eyes.

6. An article according to claim 4, wherein the mutually complementary members are comprised of beads and grooves.

7. An article according to claim 4, wherein the mutually complementary members are comprised of the male and female parts of a self-fastening tape.

8. An article according to claim 4, wherein the mutually complementary members is comprised of an adhesive coating.

9. An article according to claim 4, wherein the mutually complementary members are comprised of buttons and button holes.

10. An article according to claim 3, wherein the mutually complementary members are comprised of hooks and eyes.

11. An article according to claim 3, wherein the mutually complementary members are comprised of beads and grooves.

12. An article according to claim 3, wherein the mutually complementary members are comprised of the male and female parts of a self-fastening tape.

13. An article according to claim 3, wherein the mutually complementary members is comprised of an adhesive coating.

14. An article according to claim 3, wherein the mutually complementary members are comprised of buttons and button holes.

* * * * *

US005527303A

United States Patent [19]

Milby, Jr. et al.

[11] Patent Number: 5,527,303

[45] Date f Patent: Jun. 18, 1996

[54] **ABSORBENT ARTICLE WITH EXPANDABLE BACKSHEET**

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[73] Assignee: **The Procter & Gamble Company**, Cincinnati, Ohio

[21] Appl. No.: **375,864**

[22] Filed: **Jan. 20, 1995**

[51] **Int. Cl.**[6] **A61F 13/15**

[52] **U.S. Cl.** **604/385.1**; 604/364

[58] **Field of Search** 604/364, 365, 604/368, 385.1, 385.2, 386, 387

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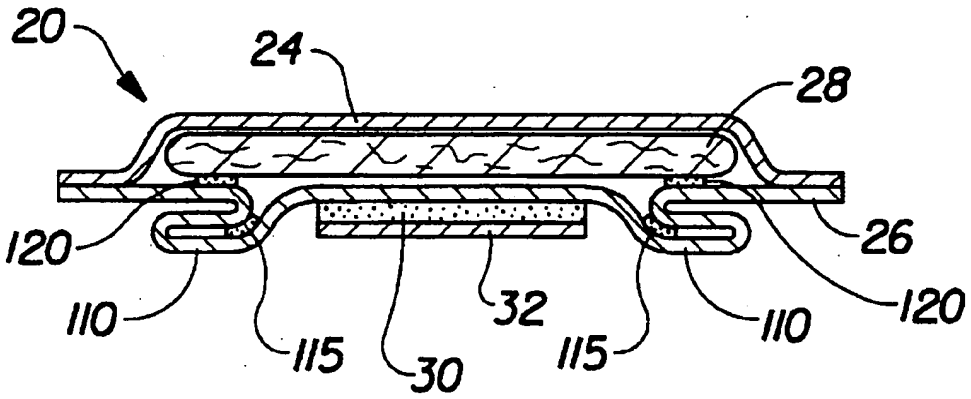
[57] **ABSTRACT**

The present invention provides a disposable absorbent article such as an incontinent pad that is both comfortable and suitable for absorbing and containing large volumes of bodily liquids without leakage. Such an absorbent article includes a liquid pervious topsheet, a liquid impervious backsheet joined to the topsheet, and an absorbent core positioned between the topsheet and the backsheet. The absorbent core includes a material which expands when wetted. The backsheet includes at least one pleat which is tacked with a liquid soluble adhesive such that when the liquid soluble adhesive is wetted the adhesive dissolves allowing the pleat to expand as the absorbent core expands. The pleats may extend in any direction, but preferably extend either substantially parallel to the longitudinal axis of the article or substantially parallel to the transverse axis of the absorbent article.

9 Claims, 2 Drawing Sheets



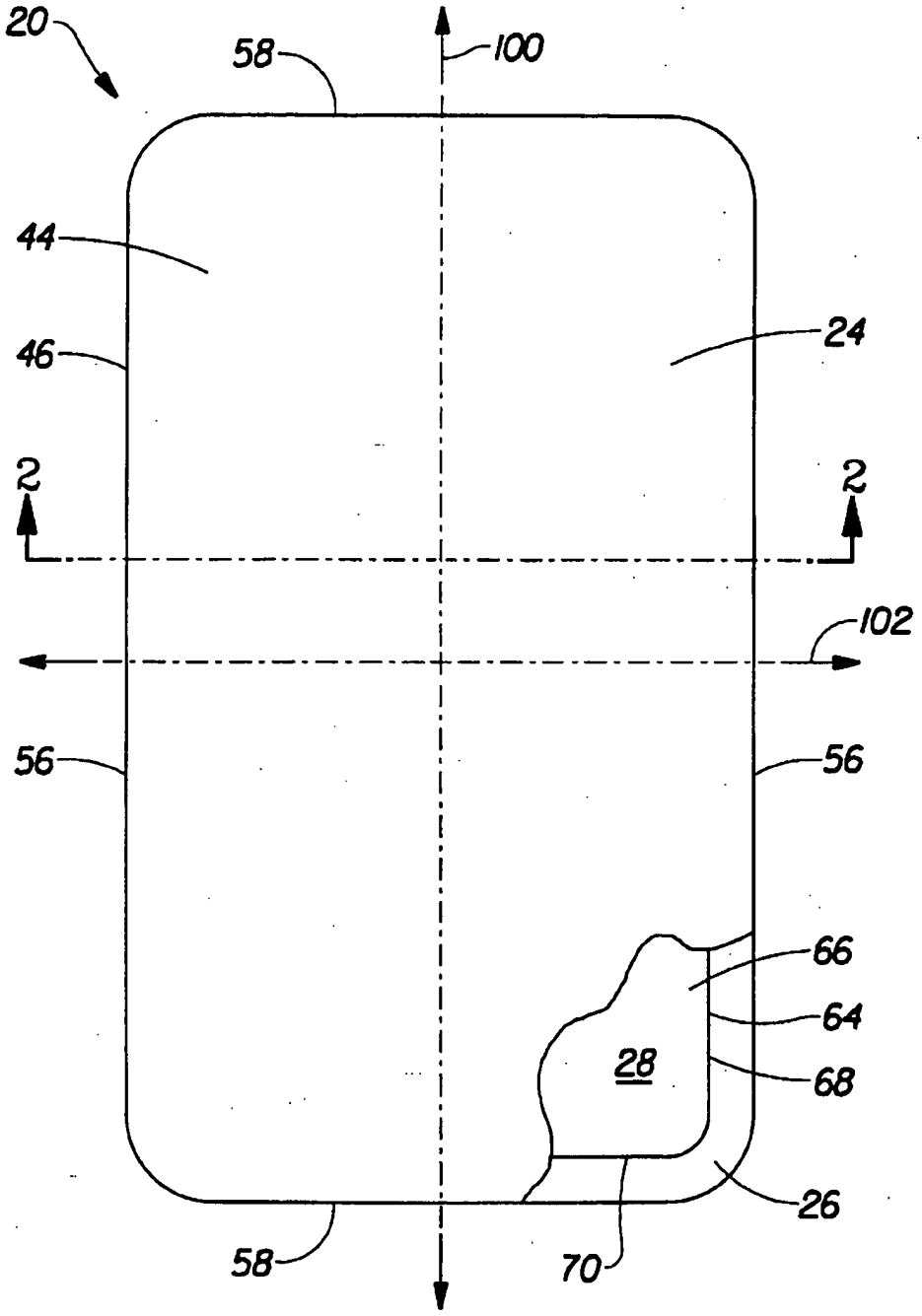
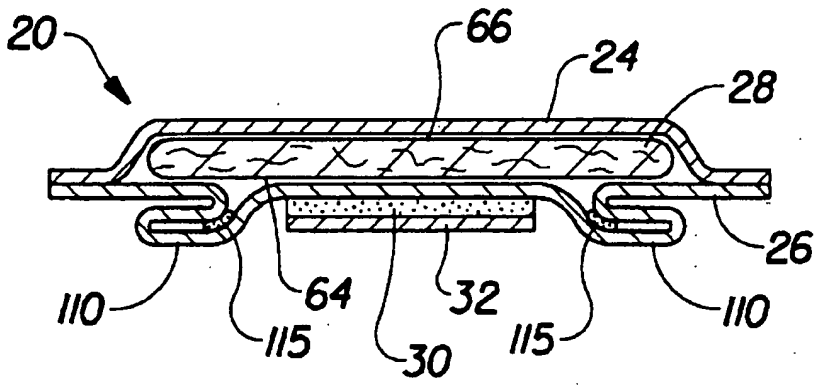


Fig. 1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26
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110
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30
115

Fig. 2

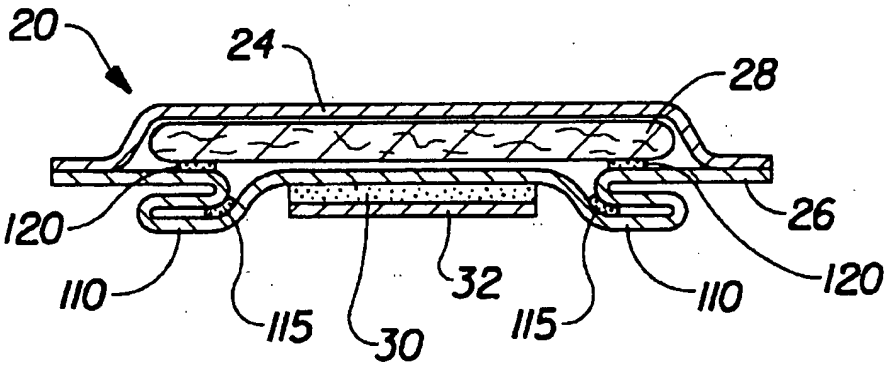
20
24
28
26
120
120
110
32
110
115
30
115

Fig. 3

ABSORBENT ARTICLE WITH EXPANDABLE BACKSHEET

FIELD OF INVENTION

The present invention relates to absorbent articles such as diapers, incontinent briefs, incontinent pads, diaper holders, training pants, sanitary napkins, pantiliners, and the like and, more particularly, to absorbent articles having an expandable backsheet.

BACKGROUND OF THE INVENTION

Infants and other incontinent individuals wear absorbent articles such as incontinent pads and diapers to receive and contain urine and other body exudates. Absorbent articles function both to contain discharged materials and to isolate these materials from the body of the wearer and from the wearer's garments and bed clothing. Disposable absorbent articles having many different basic designs are known to the art.

There is a growing awareness of the lack of satisfactory products designed for mobile persons with incontinent infirmities. While sanitary napkins, pantiliners, disposable briefs and diapers are available for the mobile incontinent person, such products are not satisfactory from either a comfort or a protection standpoint. Catamenial products such as pantiliners and sanitary napkins are very comfortable to use. However, these products fail to achieve a satisfactory level of containment for high void levels of urine. While diapers and briefs meet the containment needs of the incontinent person, these products lack the comfort and discreteness available from sanitary napkins and pantiliners.

Thus, it is desirable to provide an absorbent article such as an incontinent pad that is comfortable and discrete, yet provides superior protection and containment. In order to achieve the goal of providing such an absorbent article, it is necessary that the absorbent article be capable of rapidly accepting and containing a large volume of liquid within a small surface area; rapidly distributing the liquid efficiently throughout the product; conforming to the body of the wearer; maintaining good body contact (i.e., the maintenance of the article in close proximity to and in conformity with the body of the wearer); and maintaining its integrity even when wetted so as to be effective to accept and contain a subsequent discharge or gush of liquid and to prevent rewet (i.e., recontact of liquids contained in the article with the skin of the wearer due to forces that squeeze the liquid out of the article).

A method for increasing the absorbency of absorbent articles is to provide them with absorbent gelling materials. Absorbent gelling materials are materials which are capable of absorbing large quantities of liquids and which are further capable of retaining such absorbed liquids under moderate pressures. The absorption characteristics of absorbers gelling materials make such materials especially useful for incorporation into absorbent articles such as incontinent pads. Because absorbent gelling material swells and expands upon being wetted, an absorbent core containing absorbent gelling material will also expand when wetted. Because the overwrap is generally firmly affixed around the absorbent article, the only space available for expansion of the absorbent core is within the interior of the absorbent article. Therefore, there is a need to identify absorbent articles having absorbent cores containing absorbent gelling material wherein the overwrap can expand to accommodate the expansion of the absorbent core. Accordingly, it would be

advantageous to provide absorbent articles with an expansion means allowing the overwrap to expand as the absorbent core expands.

Therefore, it is an object of the present invention to provide an absorbent article having an overwrap and a releasing means so that when the absorbent core containing absorbent gelling material expands when wetted, the overwrap will expand as the absorbent gelling material expands.

The above and other objectives of the present invention will be more readily apparent when considered in reference to the following description and when taken in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

The present invention provides a disposable absorbent article such as an incontinent pad that is both comfortable and suitable for absorbing and containing large volumes of bodily liquids without leakage. Such an absorbent article comprises a liquid pervious topsheet, a liquid impervious backsheet joined to the topsheet, and an absorbent core positioned between the topsheet and the backsheet. The absorbent core includes a material which expands when wetted. The backsheet includes at least one pleat which is tacked with a water soluble adhesive such that when the water soluble adhesive is wetted the adhesive dissolves allowing the pleat to expand as the absorbent core expands. The pleats may extend in any direction but preferably extends either substantially parallel to the longitudinal axis of the article or substantially parallel to the transverse axis of the absorbent article.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as forming the present invention, it is believed that the invention will be better understood from the following description which is taken in conjunction with the accompanying drawings in which like designations are used to designate substantially identical elements and in which:

FIG. **1** is a plan view of an incontinent pad embodiment of the present invention having portions cut away to reveal underlying structure;

FIG. **2** is a cross-sectional view taken along section line **2—2** of FIG. **1**; and

FIG. **3** is a cross-sectional view of another embodiment of an incontinent pad of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, the term "absorbent article" refers to devices which absorb and contain body exudates, and, more specifically, refers to devices which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "disposable" is used herein to describe absorbent articles which are not intended to be laundered or otherwise restored or reused as an absorbent article (i.e., they are intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner). A preferred embodiment of an absorbent article of the present invention is the incontinent pad **20**, shown in FIG. 1 and in cross-sectional view in FIG. 2. As used herein, the term "incontinent pad" refers to an absorbent article generally worn by incontinent persons by

adhesively attaching the pad directly to the crotch region of the wearer's undergarment. It should be understood, however, that the present invention is also applicable to other absorbent articles such as incontinent briefs, diapers, diaper holders and liners, sanitary napkins, pantiliners, training pants, and the like.

FIG. 1 is a plan view of the incontinent pad 20 of the present invention with portions of the structure being cutaway to more clearly show the construction of the incontinent pad 20 and with the portion of the incontinent pad which faces or contacts the wearer, the inner surface, oriented towards the viewer. As shown in FIG. 1, the incontinent pad 20 preferably comprises a liquid pervious topsheet 24; a liquid impervious backsheet 26 joined with the topsheet 24; and an absorbent core 28 positioned between the topsheet 24 and the backsheet 26.

The incontinent pad 20 also has two centerlines, a longitudinal centerline 100 and a transverse centerline 102. The term "longitudinal", as used herein, refers to a line, axis, or direction in the plane of the incontinent pad 20 that is generally aligned with (e.g. approximately parallel with) a vertical plane which bisects a standing wearer into left and right halves when the incontinent pad 20 is worn. The terms "transverse" and "lateral", as used herein, are interchangeable and refer to a line, axis or direction which lies within the plane of the incontinent pad that is generally perpendicular to the longitudinal direction.

The incontinent pad 20 is shown in FIG. 1 to have an inner surface 44 (facing the viewer in FIG. 1), an outer surface 46 opposed to the inner surface 44, and a periphery which is defined by the outer perimeter or edges of the incontinent pad 20 in which the longitudinal edges are designated 56 and the end edges are designated 58. The inner surface 44 of the incontinent pad 20 comprises that portion of the incontinent pad 20 which is positioned adjacent to the wearer's body during use (i.e., the inner surface 44 is generally formed by at least a portion of the topsheet 24 and other components joined to the topsheet 24). The outer surface 46 comprises that portion of the incontinent pad 20 which is positioned away from the wearer's body (i.e., the outer surface 46 is generally formed by at least a portion of the backsheet 26 and other components joined to the backsheet 26). As used herein, the term "joined" encompasses configurations whereby an element is directly secured to the other element by affixing the element directly to the other element, and configurations whereby the element is indirectly secured to the other element by affixing the element to intermediate member(s) which in turn are affixed to the other element.

FIG. 1 shows a preferred embodiment of the incontinent pad 20 in which the topsheet 24 and the backsheet 26 have length and width dimensions generally larger than those of the absorbent core 28. The topsheet 24 and the backsheet 26 extend beyond the edges of the absorbent core 28 to thereby form the periphery of the incontinent pad 20.

The absorbent core 28 may be any absorbent member which is generally compressible, conformable, non-irritating to the wearer's skin, and capable of absorbing and retaining liquids such as urine and other certain body exudates. As shown in FIG. 1, the absorbent core 28 has an outer surface 64, an inner surface 66, side edges 68, and end edges 70. The absorbent core 28 may be manufactured in a wide variety of sizes and shapes (e.g., rectangular, oval, hourglass, dog bone, asymmetric, etc.) and from a wide variety of liquid-absorbent materials commonly used in incontinent pads and other absorbent articles such as comminuted wood pulp which is generally referred to as airfelt. Examples of other suitable absorbent materials include creped cellulose wadding; meltblown polymers including coform; chemically stiffened, modified or cross-linked cellulosic fibers; tissue including tissue wraps and tissue laminates; absorbent foams; absorbent sponges; superabsorbent polymers; absorbent gelling materials; or any equivalent material or combinations of materials.

The configuration and construction of the absorbent core 28 may vary (e.g., the absorbent core may have varying caliper zones, a hydrophilic gradient, a superabsorbent gradient, or lower average density and lower average basis weight acquisition zones; or may comprise one or more layers or structures). However, the total absorbent capacity of the absorbent core 28 should be compatible with the design loading and the intended use of the incontinent pad 20. The size and absorbent capacity of the absorbent core 28 may also be varied to accommodate wearers ranging from infants through adults.

Exemplary absorbent structures for use as the absorbent core 28 of the present invention that have achieved wide acceptance and commercial success are described in U.S. Pat. No. 4,610,678 entitled "High-Density Absorbent Structures" issued to Weisman et al. on Sep. 9, 1986; U.S. Pat. Nos. 4,673,402 entitled "Absorbent Articles With Dual-Layered Cores" issued to Weisman et al. on Jun. 16, 1987; U.S. Pat. Nos. 4,888,231 entitled "Absorbent Core Having A Dusting Layer" issued to Angstadt on Dec. 19, 1989; and U.S. Pat. No. 4,834,735, entitled "High Density Absorbera Members Having Lower Density and Lower Basis Weight Acquisition Zones", issued to Alemany et al. on May 30, 1989. The absorbent core may further comprise the dual core system containing acquisition/distribution core of chemically stiffened fibers positioned over the absorbent storage cores as detailed in U.S. Pat. No. 5,234,423, entitled "Absorbent Article With Elastic Waist Feature and Enhanced Absorbency" issued to Alemany et al., on Aug. 10, 1993; and in U.S. Pat. No. 5,147,345, entitled "High Efficiency Absorbent Articles For Incontinence Management" issued to Young, LaVon and Taylor on Sep. 15, 1992. All of these patents are incorporated herein by reference.

The backsheet 26 is positioned adjacent the outer surface 64 of the absorbent core 28 and is preferably joined thereto by attachment means (not shown) such as those well known in the art. For example, the backsheet 26 may be secured to the absorbent core 28 by a uniform continuous layer of adhesive, a patterned layer of adhesive, or an array of separate lines, spirals, or spots of adhesive. Adhesives which have been found to be satisfactory are manufactured by H. B. Fuller Company of St. Paul, Minn. and marketed as HL-1258. An example of a suitable attachment means comprising an open pattern network of filaments of adhesive is disclosed in U.S. Pat. No. 4,573,986 entitled "Disposable Waste-Containment Garment", which issued to Minetola et al. on Mar. 4, 1986. Another suitable attachment means comprising several lines of adhesive filaments swirled into a spiral pattern is illustrated by the apparatus and methods shown in U.S. Pat. No. 3,911,173 issued to Sprague, Jr. on Oct. 7, 1975; U.S. Pat. No. 4,785,996 issued to Ziecker, et al. on Nov. 22, 1978; and U.S. Pat. No. 4,842,666 issued to Werenicz on Jun. 27, 1989. Each of these patents are incorporated herein by reference. Alternatively, the attachment means may comprise heat bonds, pressure bonds, ultrasonic bonds, dynamic mechanical bonds, or any other suitable attachment means or combinations of these attachment means as are known in the art.

The backsheet 26 is impervious to liquids (e.g., urine) and is preferably manufactured from a thin plastic film, although

other flexible liquid impervious materials may also be used. As used herein, the term "flexible" refers to materials which are compliant and will readily conform to the general shape and contours of the human body. The backsheet **26** prevents the exudates absorbed and contained in the absorbent core **28** from wetting articles which contact the diaper **20** such as bedsheets and undergarments. Further, the backsheet **26** may permit vapors to escape from the absorbent core **28** (i.e., breathable) while still preventing exudates from passing through the backsheet **26**. Thus, the backsheet **26** may comprise a woven or nonwoven material, polymeric films such as thermoplastic films of polyethylene or polypropylene, or composite materials such as a film-coated nonwoven material. An example of a suitable backsheet is a thermoplastic film having a thickness of from about 0.012 mm (0.5 mil) to about 0.051 mm (2.0 mils). Other suitable materials for the backsheet **26** include RR8220 blown films and RR5475 cast films as manufactured by Tredegar Industries, Inc. of Terre Haute, IN. The backsheet **26** is preferably embossed and/or matte finished to provide a more cloth like appearance.

The topsheet **24** is positioned adjacent the inner surface **66** of the absorbent core **28** and is preferably joined thereto and to the backsheet **26** by attachment means (not shown) such as those well known in the art. Suitable attachment means are described with respect to joining the backsheet **26** to the absorbent core **28**. In a preferred embodiment of the present invention, the topsheet **24** and the backsheet **26** are joined directly to each other in the incontinent pad periphery and are indirectly joined together by directly joining them to the absorbent core **28** by the attachment means (not shown).

The topsheet **24** is compliant, soft feeling, and non-irritating to the wearer's skin. Further, the topsheet **24** is preferably liquid pervious permitting liquids (e.g., urine) to readily penetrate through its thickness. A suitable topsheet **24** may be manufactured from a wide range of materials, such as porous foams; reticulated foams; apertured plastic films; or woven or nonwoven webs of natural fibers (e.g., wood or cotton fibers), synthetic fibers (e.g., polyester or polypropylene fibers), or a combination of natural and synthetic fibers. The topsheet **24** is preferably made of a hydrophobic material to isolate the wearer's skin from liquids which have passed through the topsheet **24** and are contained in the absorbent core **28** (i.e. to prevent rewet). If the topsheet **24** is made of a hydrophobic material, at least the upper surface of the topsheet **24** is treated to be hydrophilic so that liquids will transfer through the topsheet more rapidly. This diminishes the likelihood that body exudates will flow off the topsheet **24** rather than being drawn through the topsheet **24** and being absorbed by the absorbent core **28**. The topsheet **24** can be rendered hydrophilic by treating it with a surfactant. Suitable methods for treating the topsheet **24** with a surfactant include spraying the topsheet **24** material with the surfactant and immersing the material into the surfactant. A more detailed discussion of such a treatment and hydrophilicity is contained in U.S. Pat. No. 4,988,344 entitled "Absorbent Articles with Multiple Layer Absorbent Layers" issued to Reising, et al on Jan. 29, 1991 and U.S. Pat. No. 4,988,345 entitled "Absorbent Articles with Rapid Acquiring Absorbent Cores" issued to Reising on Jan. 29, 1991, each of which is incorporated by reference herein.

There are a number of manufacturing techniques which may be used to manufacture the topsheet **24**. For example, the topsheet **24** may be a nonwoven web of fibers. When the topsheet **24** comprises a nonwoven web, the web may be spunbonded, carded, wet-laid, melt-blown, hydroentangled, combinations of the above, or the like. A suitable topsheet **24** is carded and thermally bonded by means well known to those skilled in the fabrics art. A satisfactory topsheet **24** comprises staple length polypropylene fibers having a denier of about 2.2. As used herein, the term "staple length fibers" refers to those fibers having a length of at least about 15.9 mm (0.625 inches). Preferably, the topsheet **24** has a basis weight from about 18 to about 25 grams per square meter. A suitable topsheet is manufactured by Veratec, Inc., a Division of International Paper Company, of Walpole, Mass. under the designation P-8.

In use, the incontinent pad **20** can be held in place by any support means or attachment means well-known for such purposes. Preferably, the incontinent pad **20** is placed in the user's undergarment or panty and secured thereto by a fastener such as an adhesive **30**, shown in FIG. **2**. The adhesive **30** provides a means for securing the incontinent pad in the crotch portion of the undergarment. Thus, a portion or all of the outer surface of the backsheet **26** may be coated with an adhesive. Any adhesive or glue used in the art for such purposes can be used for the adhesive herein, with pressure-sensitive adhesives being preferred. Suitable adhesives are Century A-305-IV manufactured by the Century Adhesives Corporation of Columbus, Ohio; and Instant Lock 34-2823 manufactured by the National Starch and Chemical Company of Bridgewater, N.J. Suitable adhesive fasteners are also described in U.S. Pat. No. **4,917,697**. Before the incontinent pad is placed in use, the pressure-sensitive adhesive **30** is typically covered with a removable release liner **32** in order to keep the adhesive from drying out or adhering to a surface other than the crotch portion of the undergarment prior to use. Suitable release liners are also described in the above-referenced U.S. Pat. No. 4,917,697. Any commercially available release liners commonly used for such purposes can be utilized herein. Non-limiting examples of suitable release liners are BL30MG-A Silox E1/0 and BL30MG-A Silox 4P/O both of which are manufactured by the Akrosil Corporation of Menasha, Wis. The incontinent pad **20** of the present invention is used by removing the release liner and thereafter placing the incontinent pad in a panty or undergarment so that the adhesive contacts the panty or undergarment. The adhesive maintains incontinent pad in position within the panty or undergarment during use.

In a preferred embodiment of the present invention, an acquisition layer(s) may be positioned between the topsheet and the absorbent core. The acquisition layer may serve several functions including improving wicking of liquids over and into the absorbent core. There are several reasons why the improved wicking of liquids is important, including providing a more even distribution of the liquids throughout the absorbent core and allowing the incontinent pad **20** to be made relatively thin. (The wicking referred to herein may encompass the transportation of liquids in one, two, or all directions, i.e., in the x-y plane and/or in the z-direction.) The acquisition layer may be comprised of several different materials including nonwoven or woven webs of synthetic fibers including polyester, polypropylene, or polyethylenes; natural fibers including cotton or cellulose; blends of such fibers; or any equivalent materials or combinations of materials. In a preferred embodiment, the acquisition layer may be joined with the topsheet by any of the conventional means for joining webs together.

The backsheet **26** includes pleats **110** extending longitudinally along the length of the incontinent pad **20**. The pleats **110** extend in a direction substantially parallel to the longitudinal axis **100** of the incontinent pad. The pleats **110** are tacked or secured with a liquid soluble adhesive **115**. The

liquid soluble adhesive **115** may be placed along the entire length of the pleat **110** or at discrete locations along the length of the pleat. Suitable liquid soluble adhesives are manufactured by H. B. Fuller Company of St. Paul, Minn. and marketed as NP-2088 and NP-2089.

The liquid soluble adhesive **115** dissolves when exposed to liquid permitting the pleats **110** to expand, open or unfold, thus allowing the backsheet **26** to expand in the transverse direction. Without the expansion of the pleats **110** in the backsheet **26**, s the expansion of the absorbent core **28** would deform the shape of the incontinent pad **20** causing an increase in discomfort and a decrease in its liquid acquisition properties. The expansion of the pleats in the backsheet **26** also prevents the absorbent core **28** from being squeezed as it expands so that the danger of rewet is decreased.

In the embodiment shown in FIG. **2**, the incontinent pad **20** includes a pair of pleats **110** positioned on either side of the adhesive **30**. Alternatively, the incontinent pad may comprise a single pleat, or may comprise a plurality of pleats extending along the entire length or a portion of the length of the incontinent pad **20**.

In another embodiment (not shown), the pleats **110** may extend in a direction substantially parallel to the transverse axis **102** of the incontinent pad **20**. Thus, the pleats allow the backsheet **26** to expand in the longitudinal direction and thus allow the absorbent core to expand in the same longitudinal direction.

In the embodiment shown in FIG. **3**, the incontinent pad **20** includes a pair of pleats **110** extending in a direction substantially parallel to the longitudinal axis **100** of the incontinent pad. The pleats **110** are tacked with a liquid soluble adhesive **115**. The pleats **110** are also tacked to the absorbent core **28** with a liquid soluble adhesive **120**.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. An absorbent article having a longitudinal axis and a transverse axis, said absorbent article comprising: a liquid pervious topsheet, a liquid impervious backsheet joined to said topsheet, and an absorbent core positioned between said topsheet and said backsheet, said absorbent core comprising a material that expands when wetted, said backsheet having at least one pleat, said pleat being tacked with a liquid soluble adhesive such that when said liquid soluble adhesive is wetted said adhesive dissolves allowing said pleat to expand as said absorbent core expands.

2. The absorbent article of claim **1** wherein said at least one pleat extends in a direction substantially parallel to said longitudinal axis.

3. The absorbent article of claim **1** wherein said backsheet includes a plurality of pleats.

4. The absorbent article of claim **3** wherein said pleats extend in a direction substantially parallel to said longitudinal axis.

5. The absorbent article of claim **3** wherein said pleats extend in a direction substantially parallel to said transverse axis.

6. The absorbent article of claim **1** further comprising an adhesive for securing said absorbent article in a user's undergarment.

7. The absorbent article of claim **1** wherein said absorbent article is an incontinent pad.

8. The absorbent article of claim **1** wherein said absorbent core contains absorbent gelling material.

9. The absorbent article of claim **1** further comprising a liquid soluble adhesive securing said at least one pleat to said absorbent core.

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